Final
Environmental Assessment

San Antonio Creek Restoration

Vandenberg Air Force Base
California

8 September 2008

Report Documentation Page

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FINDING OF NO SIGNIFICANT IMPACT

AND FINDING OF NO PRACTICABLE ALTERNATIVE

San Antonio Creek Restoration

at Vandenberg Air Force Base, California

Pursuant to provisions of the National Environmental Policy Act (NEPA), 42 U.S. Code 4321 *et seq.*, implementing Council on Environmental Quality (CEQ) Regulations, 40 Code of Federal Regulations (CFR) 1500-1508, and 32 CFR Part 989, *Environmental Impact Analysis Process*, the U.S. Air Force (Air Force) conducted an assessment of the potential environmental consequences associated with restoring 0.875 mile of San Antonio Creek on Vandenberg Air Force Base (VAFB), California.

The Environmental Assessment (EA), incorporated by reference to this finding, considers all potential impacts of the Proposed Action and No-Action Alternative, both as a solitary action, and cumulatively in conjunction with other projects at VAFB. The EA analyzes the potential environmental consequences of activities associated with the proposed creek restoration, and provides guidelines to avoid adverse environmental effects.

PROPOSED ACTION

The proposed project would remediate extensive damage to the banks and stream channel of San Antonio Creek, restore hydrologic function, enhance stream stability, minimize potential for further erosion, and begin to return channel morphology to a proper functioning condition. The restoration would entail constructing in-stream rock riffle grade controls at seven sites and bioengineering bank stabilization at three sites within San Antonio Creek, between U.S. Highway 1 and the Lee Road Utility Bridge. Constraints applicable to the Proposed Action are discussed under their relevant resource.

Only the No-Action Alternative is considered in addition to the Proposed Action. No other viable alternatives to the Proposed Action were identified. Implementation of the No-Action Alternative would result in the restoration and bank protection measures not being implemented within San Antonio Creek. Because the banks would remain unprotected, San Antonio Creek would continue to migrate toward San Antonio Road West, eventually undermining the roadway and forcing the closure of the road. In addition, the Lee Road Utility Bridge abutments could be undermined and fail during future major creek flows, threatening the bridge structure and utilities it supports.

SUMMARY OF FINDINGS

The analyses of the affected environment and environmental consequences of implementing the Proposed Action presented in the EA concluded that with implementation of the environmental protection and monitoring measures described in Chapter 4, no adverse effects should result to Earth Resources (Section 4.4), Hazardous Materials and Waste Management

(Section 4.5), Human Health and Safety (Section 4.6), Land Use and Aesthetics (Section 4.7), and Transportation (Section 4.8). In addition, the EA concluded that the Proposed Action would not affect Environmental Justice, Socioeconomics, and Solid Waste Management.

No cumulative adverse impacts should result from activities associated with the restoration of San Antonio Creek, when considered in conjunction with recent past and future projects on VAFB (Section 4.8).

While the Proposed Action is not located within the California Coastal Zone, given potential, temporary, downstream effects during implementation the Proposed Action, Vandenberg AFB will submit a Negative Determination to the California Coastal Commission and obtain concurrence prior to initiation of the project in accordance with the Coastal Zone Management Act.

Four areas of environmental consequences evaluated in the EA were determined to have the potential to result in less than significant impacts to the environment.

Air Quality

Fugitive dust emissions generated from equipment operating on exposed ground and combustive emissions from the equipment would cause adverse air quality impacts. However, no significant impacts are anticipated (see EA Sections 3.1 and 4.1). Emissions from the Proposed Action would not exceed significance thresholds; therefore, no adverse impacts to the region's air quality would occur. All measures described in the EA will be implemented to further decrease emissions during project activities.

Biological Resources

The proposed creek restoration has the potential to result in short-term temporary adverse effects to biological resources in the immediate area of disturbance, and long-term permanent beneficial effects from improved habitat and ecological function. Federal threatened and endangered species that occur or have the potential to occur within the project area include: unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), California red-legged frog (*Rana aurora draytonii*), El Segundo blue butterfly (*Euphilotes battoides allyni*), and Gaviota tarplant (*Deinandra increscens* ssp. *villosa*). No significant adverse impacts to these species are anticipated with the implementation of the environmental protection and monitoring measures described in the EA.

Cultural Resources

Nine previously recorded archaeological sites and one isolated artifact are recorded within 0.25 mile of the proposed project area. Seven cultural resources are within or immediately adjacent to the creek restoration area. Project activities were developed to avoid adverse effects to known resources, where possible. However, one archaeological site could not be avoided. Because the site is deeply buried, VAFB assumes the site is eligible for the NRHP (spell out, not used again) for the purposes of the proposed project only. Therefore, VAFB has determined that the Proposed Action would have an adverse effect to one historic property. This determination and the associated studies are documented within a Historic Property Survey

Report, which was submitted to the California State Historic Preservation Officer (SHPO) for review and a request for concurrence. VAFB will seek measures to mitigate the project's adverse effects to acceptable levels with the SHPO and Santa Ynez Band of Chumash Indians. These measures will be contained within a Historic Property Treatment Plan, accompanied by a Memorandum of Agreement (MOA). Upon signature of the MOA by consulting parties, the terms outlined in the Historic Property Treatment Plan would be fully implemented.

Water Resources

The Proposed Action would require coverage under the National Pollutant Discharge Elimination System (NPDES) Construction General Permit because the total disturbed area would be greater than one acre. A Storm Water Pollution Prevention Plan would be developed and implemented to maintain compliance with the NPDES Construction General Permit. Due to direct impacts to water bodies and wetlands, VAFB would obtain a Clean Water Act (CWA) Section 401 Water Quality Certification from the Central Coast Regional Water Quality Control Board and a CWA Section 404 Permit from the United States Army Corps of Engineers prior to the commencement of construction.

During site preparation and construction activities, storm water/erosion best management practices (BMPs) would be implemented during and after any clearing, excavation, and grading. Long-term BMPs would be put in place to address storm water erosion after project completion. Implementing these procedures and requirements should prevent adverse effects as a result of restoration activities. No significant impacts are anticipated to water resources with the implementation of the environmental protection and monitoring measures described in the EA.

PRACTICABLE ALTERNATIVES

Because the Proposed Action would occur within the 100-year floodplain of San Antonio Creek, as defined by the Federal Emergency Management Agency, no practicable alternative to the Proposed Action is possible.

FINDING OF NO PRACTICABLE ALTERNATIVE

Pursuant to Executive Order 11990 and 32 CFR 989.14(g), the authority delegated in SAFO 791.1 and taking the information contained in the attached EA into consideration, I find that there is no practicable alternative to implementing the Proposed Action in a floodplain and wetlands. The Proposed Action, as designed, includes all practicable measures to minimize harm. Before undertaking this action, VAFB officials will complete all relevant regulatory processes, and subsequently abide by all permit conditions and mitigations.

FINDING OF NO SIGNIFICANT IMPACT

Based upon my review of the facts and analyses contained in the attached EA, conducted in accordance with the provisions of NEPA, the CEQ Regulations, and 32 CFR Part 989, I conclude that the Proposed Action should not have a significant environmental impact, either by itself or cumulatively with other projects at VAFB. Accordingly, an Environmental Impact

Statement is not required. The signing of this Finding of No Significant Impact and Finding of No Practicable Alternative completes the environmental impact analysis process.

FINDING OF NO SIGNIFICANT IMPACT and
FINDING OF NO PRACTICABLE ALTERNATIVE
CONCURRENCE PAGE

In Conjunction with Final Environmental Assessment for the San Antonio Creek Restoration at Vandenberg Air Force Base, California

MAJCOM Approval:

Carlos R. Cruz-Gonzalez

CARLOS R. CRUZ-GONZALEZ
Colonel, USAF
Deputy Director of Installations

10 Sep 08
Date

Final
Environmental Assessment

San Antonio Creek Restoration

Vandenberg Air Force Base
California

Prepared for:

Department of the Air Force
30th Space Wing Civil Engineer Squadron Environmental Flight
Vandenberg Air Force Base, California

8 September 2008

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Acronyms and Abbreviations

%	Percent
ºC	Degrees Celsius
µg/m^3	Micrograms per cubic meter
30 CES	30th Civil Engineer Squadron
30 CES/CC	30th Civil Engineer Squadron, Commander
30 CES/CD	30th Civil Engineer Squadron, Deputy Commander
30 CES/CEV	30th Civil Engineer Squadron, Environmental Flight
30 MDOS/SGOAB	30th Medical Operations Squadron, Bioenvironmental Engineering Element
30 SW	30th Space Wing
30 SWP	30th Space Wing Plan
30 SW/SE	30th Space Wing, Safety Office
A.D.	Anno Domini
AFI	Air Force Instruction
AFOSH	Air Force Occupational Safety and Health
Air Force	United States Air Force
AOC	Area of Concern
AOI	Area of Interest
Aspen	Aspen Environmental Group and Simons, Li and Associates
Base	Vandenberg Air Force Base
Basin Plan	Central Coast Regional Water Quality Control Board Water Quality Control Plan
B.C.	Before Christ
BCC	Federal Bird of Conservation Concern
BMP	Best Management Practice
Caltrans	California Department of Transportation
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHP	California Highway Patrol
cm	Centimeter
CMP	Corrugated Metal Pipe
CO	Carbon monoxide
CSC	California Species of Concern
CWA	Clean Water Act
dB	Decibel
dBA	A-weighted decibel
DO	Dissolved oxygen
EA	Environmental Assessment
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
EPP	Environmental Protection Plan

ESA	Endangered Species Act
FE	Federal Endangered Species
FEMA	Federal Emergency Management Agency
FONPA	Finding of No Practicable Alternative
FONSI	Finding of No Significant Impact
ft	Feet
FT	Federal Threatened Species
GPS	Global Positioning System
GIS	Geographic Information System
HDR	HDR Engineering, Inc.
H:V	Horizontal:Vertical
H_2S	Hydrogen sulfide
HazMart	Hazardous Materials Pharmacy
Hwy	Highway
IRP	Installation Restoration Program
L_{eq1H}	One-hour average sound level
lbs	Pounds
lbs/day	Pounds per day
LOS	Level of Service
m	meter
mg/L	Milligrams per liter
mi	Mile
mi^2	Square mile
MILCON	Military construction
MOA	Memorandum of Agreement
mm Hg	Millimeters of mercury
mph	Miles per hour
MSRS	ManTech SRS Technologies, Inc.
NAAQS	National Ambient Air Quality Standards
NCA	Noise Control Act
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NOAA Fisheries Service	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O_3	Ozone
O&M	Operations and maintenance
OHWM	Ordinary high water mark
OSHA	Occupational Safety and Health Administration
Pb	Lead
$PM_{2.5}$	Particulate matter 2.5 microns or less in diameter
PM_{10}	Particulate matter 10 microns or less in diameter
POL	Petroleum, oil and lubricant
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
ROC	Reactive Organic Compound
RWQCB	Regional Water Quality Control Board

SAIC	Science Applications International Corporation
SBCAPCD	Santa Barbara County Air Pollution Control District
SCAQMD	South Coast Air Quality Management District
SE	California Endangered Species
SEL	Sound exposure level
SHPO	State Historic Preservation Officer
SO_2	Sulfur dioxide
SO_4	Sulfates
SR	State Route
SRS	SRS Technologies, Inc.
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TDS	Total dissolved solid
tons/yr	Tons per year
TSS	Total suspended solids
UCSB	University of California, Santa Barbara
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAFB	Vandenberg Air Force Base
VMSE	Vegetated mechanically stabilized earth
VOC	Volatile organic compound
WDR	Waste Discharge Requirement
yd^3	Cubic yard

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Chapter 1. Purpose of and Need for the Proposed Action

This Environmental Assessment (EA) evaluates the potential environmental consequences of restoring 0.875 mile (mi) of San Antonio Creek on Vandenberg Air Force Base (VAFB or Base), California. The National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ) regulations require lead agencies to evaluate the potential impacts of federal actions on the human environment. The United States (U.S.) Air Force (Air Force or USAF) is the lead agency for NEPA compliance on the proposed project.

This EA has been prepared in accordance with the NEPA of 1969, as amended (42 U.S. Code [U.S.C.] 4321 et seq.); as implemented by CEQ Regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); and 32 CFR Part 989.

1.1 Project Location

VAFB is headquarters for the 30th Space Wing (30 SW). The Air Force's primary missions at VAFB are to launch and track satellites in space, to test and evaluate America's intercontinental ballistic missile systems, and support aircraft operations in the Western Range. As a non-military facet of operations, VAFB is also committed to promoting commercial space launch ventures.

VAFB is located on the south-central coast of California, approximately halfway between San Diego and San Francisco (Figure 1-1). The Base covers approximately 99,000 acres in western Santa Barbara County (VAFB 2007), and occurs in a transitional ecological region that includes the northern and southern distributional limits for many plant and animal species.

The proposed project area is located within the San Antonio Creek watershed between Highway (Hwy) 1 and the El Rancho Lateral Road-Lompoc Casmalia Road intersection. Figure 1-2 illustrates the regional location of the project area. San Antonio Creek is a 28-mile long, east-west trending creek, entering north VAFB at Barka Slough, on its eastern boundary, approximately 2 mi west of the San Antonio Road East/State Route (SR) 135 interchange and emptying into the Pacific Ocean north of Purisima Point. The San Antonio Creek drainage basin is an elongated basin encompassing approximately 154 square miles (mi^2) that includes Los Alamos Valley in the upstream portion and San Antonio Valley in the downstream portion. Although intermittent through much of its course, the creek is perennial west of Barka Slough. The creek exists in a fairly natural condition along its entire length. It flows through the bottom of the valley with a meandering channel lined with riparian vegetation. Although the creek's flow is generally sluggish west of Barka Slough, San Antonio Creek is an actively changing watercourse that is often deeply entrenched 15 feet (ft) or more.

1.2 Background

San Antonio Creek is actively adjusting its profile and channel geometry between Barka Slough and Lompoc-Casmalia Road, and has experienced significant erosion (degradation), deposition (aggradation), channel widening, and bend migration in recent years. Studies completed in this reach of the creek (Aspen Environmental Group and Simons, Li and Associates [Aspen] 1998; Tetra Tech 2000, 2002; U.S. Army Corps of Engineers [USACE] 2004; HDR Engineering, Inc. [HDR] 2006)

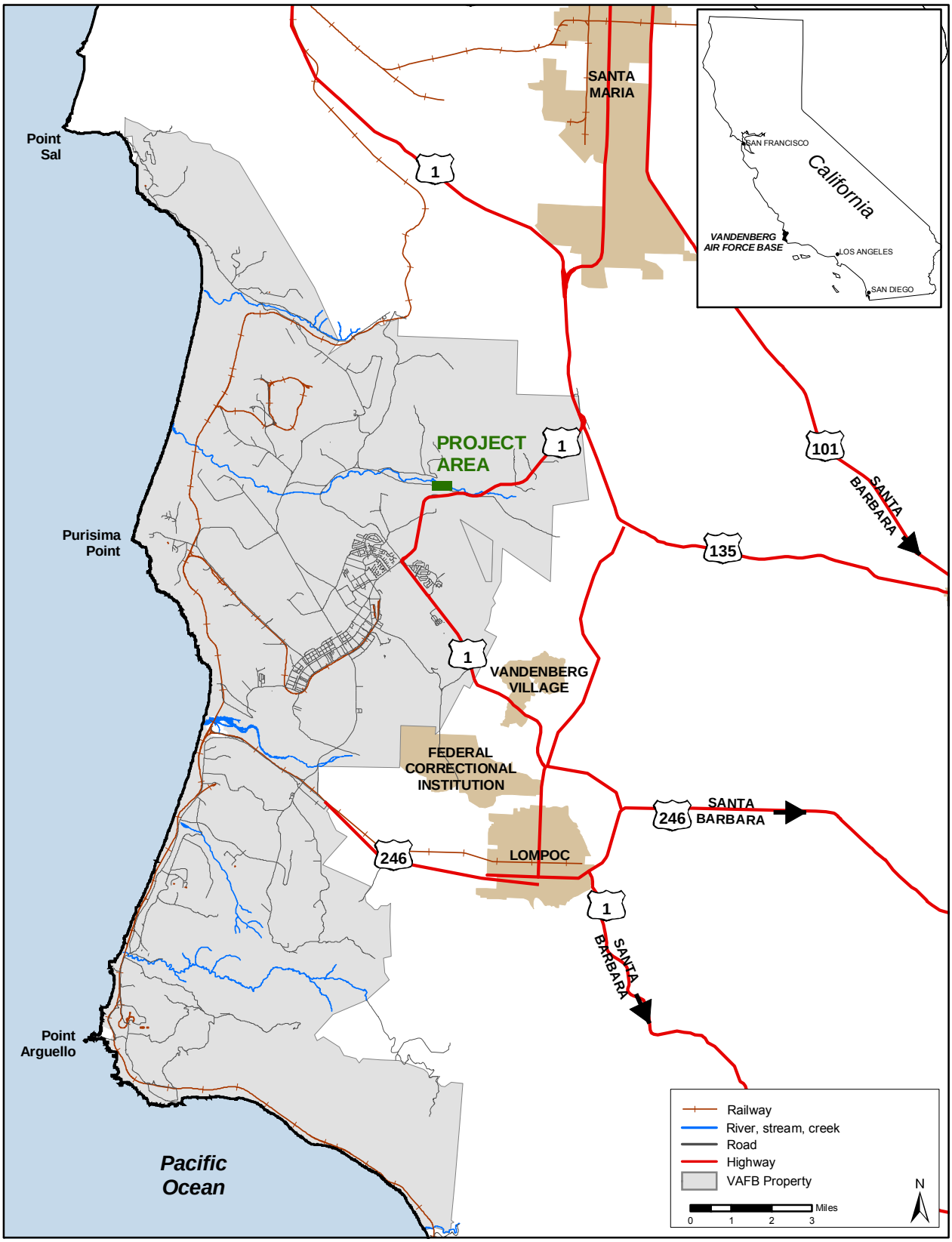

Figure 1-1. Regional location of VAFB.

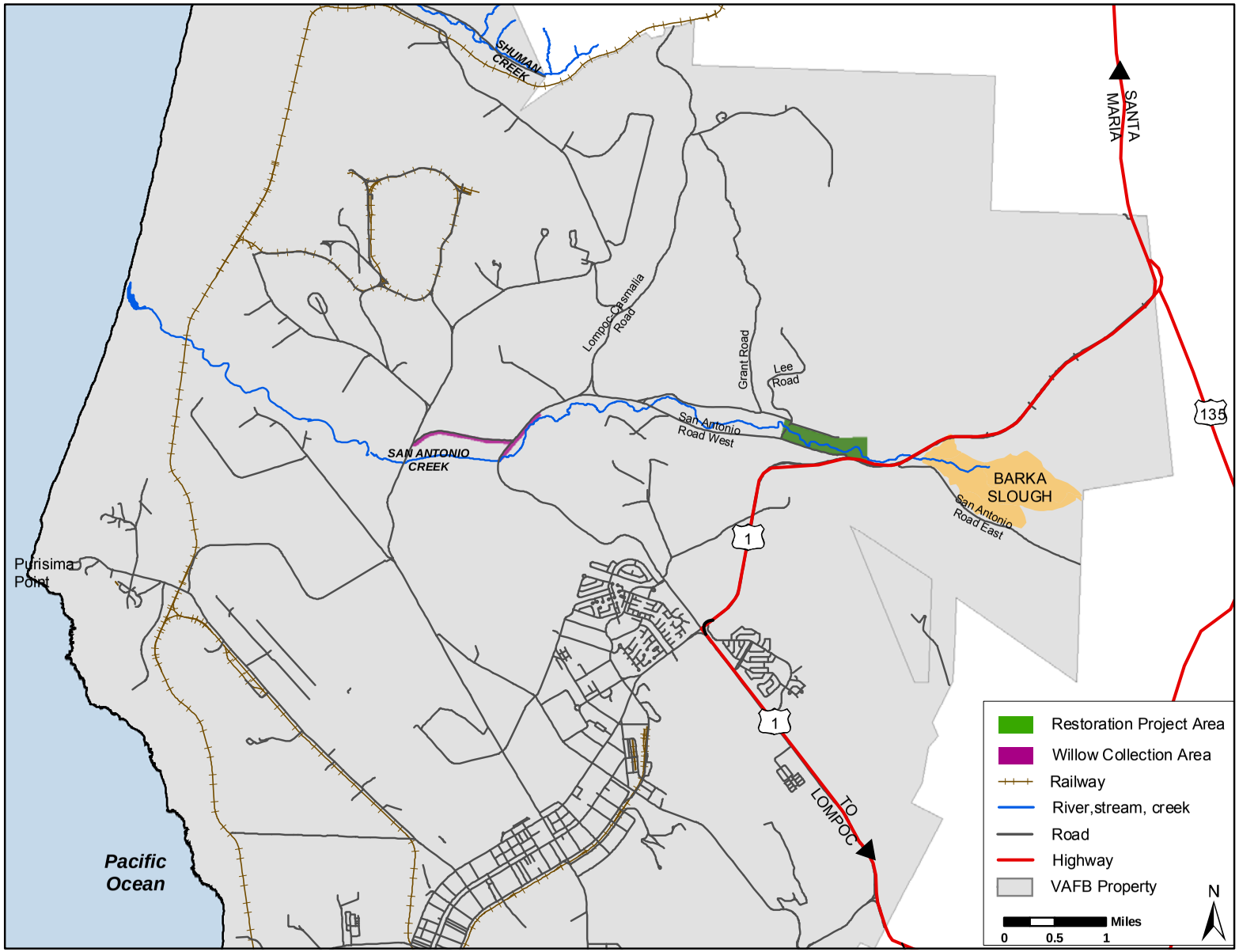

Figure 1-2. Proposed project areas and vicinity.

indicate that this trend is expected to continue. The effects of this instability have led to a degraded stream channel environment, and hydrologic disconnection of the stream from the surrounding floodplain. In addition, local infrastructure such as utilities, a highway, and roads are threatened.

Storm flows in February 1998 caused erosion damage in several areas along San Antonio Creek, between Hwy 1 and the Lee Road Utility Bridge, as well as a tributary to the creek, threatening roadways, a bridge structure, and utility lines. Emergency repairs to three sites were performed in late February and early March of 1998 to protect threatened facilities.

The emergency repairs performed at the San Antonio Road West-Creek Bend and Lee Road Utility Bridge sites are not considered adequate to provide long-term protection against bank erosion. The emergency nature of the repairs prevented the use of more durable construction methods, such as embedding riprap below the surface of the stream bed, properly compacting fill material, securely placing the riprap on the bank slopes, and installing geotextile fabric underneath the riprap to help prevent erosion of the underlying soil. Additional protection is needed at these sites to prevent the toe of the bank from being undermined by anticipated heavy flows during future storms.

The San Antonio Road West-Creek Bend Site sustained erosion along a bend in the stream course that caused the southern bank of the channel to migrate into the roadway embankment. Further undercutting of the embankment during future storms could undermine the roadway, causing the closure of San Antonio Road West. San Antonio Road West links Hwy 1 and Lompoc-Casmalia Road, and provides critical access to facilities on north VAFB. The Lee Road Utility Bridge supports a water line that carries water from remote well locations to the water treatment facility on San Antonio Road West. A second water line carries treated water back across the bridge to facilities on VAFB, north of San Antonio Creek.

1.3 Purpose of the Proposed Action

VAFB proposes to remediate extensive damage to the banks and stream channel caused by heavy storm flows to this reach of San Antonio Creek, which has resulted in severe scouring and erosion, particularly in the area between Barka Slough and the downstream crossing of San Antonio Road West. Over time, this reach of the creek has become entrenched within a deeply incised channel. Scouring from storm flows has gradually lowered the bed of the channel and bank erosion has produced steep channel walls. The goals of the proposed restoration are to restore hydrologic function, enhance stream stability, minimize potential for further erosion, protect several creek embankments, and begin to return channel morphology to a proper functioning condition.

1.4 Need for the Proposed Action

Under present conditions, eventual collapse of several creek embankments near Hwy 1 is unavoidable, which would cause: failure of San Antonio Road West and the Lee Road Utility Bridge, severing vital transportation and utility links to north VAFB; impacts to space launch missions; and, potential loss of life and mission assets. Long detours would be required for all traffic, causing considerable delay and loss of productivity for personnel working on north VAFB, and incurring additional costs for permitting and transport of hazardous cargoes.

1.5 Scope of the Environmental Assessment

Consistent with Title 32 CFR Part 989, and CEQ regulations (40 CFR 1500-1508), the scope of analysis presented in this EA is defined by the potential range of environmental impacts resulting from implementing the Proposed Action and Alternatives. Pursuant to 40 CFR Part

1501.4(c), resources potentially impacted are considered in more detail to provide sufficient evidence and analysis to determine whether or not to prepare an environmental impact statement. This EA identifies, describes, and evaluates the potential environmental impacts that could result from the Proposed Action and No-Action Alternative. No other alternatives were deemed feasible due to potential adverse effects to natural and cultural resources.

This EA also considers and evaluates possible cumulative impacts from other past, present, and planned actions on VAFB. In addition, the EA identifies environmental permits relevant to the Proposed Action. As appropriate, the EA describes, in terms of a regional overview or a site-specific description, the affected environment and environmental consequences of the Proposed Action, and identifies measures to prevent or minimize environmental impacts.

Because the Proposed Action would occur within the 100-year floodplain of San Antonio Creek, as defined by the Federal Emergency Management Agency (FEMA), and within a wetland, no practicable alternative to the Proposed Action is possible. All other alternatives considered would also occur within a wetland and were dismissed due to significant impacts as described in Chapter 2. Per 32 CFR Part 989, and Executive Orders (EOs) 11988 and 11990, a Finding of No Significant Impact/Finding of No Practicable Alternative (FONSI/FONPA) must be prepared.

Resources analyzed in this EA include air quality; biological resources; cultural resources; earth resources; hazardous materials and hazardous waste management; human health and safety; land use and aesthetics; noise; transportation; and water resources. The following resources were considered but not analyzed in this EA:

- *Environmental Justice*. Per EO 12898, *Environmental Justice*, the potential effects of the Proposed Action on minority communities and low-income communities were considered. Because the Proposed Action and any potential effects would occur within VAFB boundaries, it would not affect low income or minority populations within the region (Lompoc and Santa Maria Valleys).

- *Socioeconomics*. The short-term nature (approximately 7 to 10 weeks) and the minimal manning (approximately 30 to 40 workers) associated with the Proposed Action would not affect the socioeconomic conditions of the region (Lompoc and Santa Maria Valleys).

- *Solid Waste Management*. It is anticipated that minimal amounts of solid waste would be generated during project implementation. No demolition or deconstruction debris would be generated. All activities associated with the Proposed Action would be performed in accordance with VAFB's *Pollution Prevention Management Plan*. In addition, while only minimal amounts of solid waste are anticipated to be generated from the Proposed Action, solid waste from the project would be minimized by strict compliance with applicable federal and state statutes and regulations, as well as by following requirements contained in the 30 SW Plan (SWP) 32-7042, *Solid Waste Management Plan*. Solid waste generated during project activities would be disposed of in the VAFB Sanitary Landfill or taken off Base property for recycling or disposal.

A list of acronyms and abbreviations used in this EA is included after the Table of Contents.

1.6 Applicable Regulatory Requirements

Federal and state regulations applicable to the Proposed Action and the No-Action Alternative are summarized in Table 1-1.

Table 1-1. Federal and state regulations applicable to the implementation of the Proposed Action.

Federal Regulation	Activity or Requirement
American Indian Religious Freedom Act of 1978 (42 U.S.C 1996)	The American Indian Religious Freedom Act states that the policies and procedures of federal agencies must comply with the constitutional clause prohibiting abridgment of religious freedom—including freedom of belief, expression, and exercise—for Native Americans. The American Indian Religious Freedom Act policy is to consider Native American access to sites, use and possession of sacred objects, and freedom to worship, and directs federal agencies to revise policies and procedures to correct conflicts with Native American religious cultural rights and practices.
Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469a et seq.)	The Archaeological and Historic Preservation Act is directed toward the preservation of historic and archaeological data that would otherwise be lost as a result of federal construction or other federally licensed or assisted activities. The Archaeological and Historic Preservation Act authorizes the Department of the Interior to undertake recovery, protection, and preservation of archaeological or historic data.
Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-mm), Supplemental Regulations of 1984	The Archaeological Resources Protection Act secures protection of archaeological resources and sites on public and Indian lands; requires permitting for any excavation or collection of archaeological material from these lands; and provides civil and criminal penalties for violations.
Clean Air Act of 1970 (42 U.S.C. 7401 et seq.)	The Clean Air Act states that applicable national ambient air quality standards must be maintained during the operation of any emission source. National Ambient Air Quality Standards include primary and secondary standards for various pollutants. The primary standards are mandated by the Clean Air Act to protect public health, while the secondary standards are intended to protect the public welfare from adverse impacts of pollution, such as visibility impairment.
Clean Air Act Amendments of 1990	These amendments establish new federal non-attainment classifications, new emissions control requirements, and new compliance dates for areas in non-attainment. The requirements and compliance dates are based on the non-attainment classification.
Clean Water Act of 1977 as amended (33 U.S.C. 1251 et seq.)	Prohibits the discharge of pollutants from a point source into navigable Waters of the US, except in compliance with a National Pollutant Discharge Elimination System (40 CFR Part 122) permit. Navigable Waters of the US are considered to encompass any body of water whose use, degradation, or destruction will affect interstate or foreign commerce. Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Activities in waters of the US that are regulated under this program include fills for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports), and conversion of wetlands to uplands for farming and forestry. Section 401 of the Clean Water Act requires that the discharge of dredged or fill material into water of the U.S. does not violate state water quality standards. Generally, no Clean Water Act Sec. 404 permits will be issued until the State has been notified and the applicant has obtained a certification of state water quality standards.
Coastal Zone Management Act of 1972 (16 U.S.C. 2452-24645).	The Coastal Zone Management Act plays a significant role in water quality management. Under the Act, a federal action that may affect the coastal zone must be carried out in a manner that is consistent with state coastal zone management programs.
Endangered Species Act of 1973 (7 U.S.C. 136; 16 U.S.C. 460 et seq.)	Declares the intention of Congress to conserve threatened and endangered species and the ecosystems on which these species depend. The Endangered Species Act requires that federal agencies, in consultation with the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration National Marine Fisheries Service, use their authorities in furtherance of its purposes by carrying out programs for the conservation of endangered or threatened species.
Section 7 of the Endangered Species Act (16 U.S.C. 1536)	Contains provisions that require federal agencies to consult with the Secretary of Interior and to take necessary actions to ensure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of endangered species and threatened species.
Energy Policy Act of 1992 as amended (42 U.S.C. 8256 et seq.)	The Energy Policy Act requires that federal agencies significantly reduce their use of energy and reduce environmental impacts by promoting the use of energy-efficient and renewable energy technologies.
Migratory Bird Treaty Act of 1918 as amended (16 U.S.C. 703-712)	The Migratory Bird Treaty Act implements various treaties and conventions between the United States and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.

Federal Regulation	Activity or Requirement
National Environmental Policy Act of 1969 as amended (42 U.S.C. 4321-4347)	Requires federal agencies to analyze the potential environmental impacts of major federal actions and alternatives and to use these analyses as a decision-making tool on whether and how to proceed.
National Historic Preservation Act of 1966 as amended (16 U.S.C. 470 et seq.)	The National Historic Preservation Act is the key federal law establishing the foundation and framework for historic preservation in the U.S. The Act authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places, establishes an Advisory Council on Historic Preservation as an independent federal entity; requires federal agencies to take into account the effects of their undertakings on historic properties, and to afford the Council an opportunity to comment upon any undertaking that may affect properties listed, or eligible for listing, in the Register; and makes the heads of all federal agencies responsible for the preservation of historic properties owned or controlled by them.
Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-3013)	The Native American Graves Protection and Repatriation Act restores certain rights to Native Americans with respect to the disposition of ancestral human remains and cultural objects; vests ownership of these materials (from federal or tribal lands) with designated Native American groups; requires notification of federal agency head when Native American cultural items are discovered on federal or tribal lands; prohibits trafficking in Native American human remains and cultural items; requires inventory and tribal notification of human remains and associated funerary objects held in existing collections by museums or federal agencies; and provides for repatriation of these materials.
Noise Control Act of 1972 (42 U.S.C. 4901 et seq.)	The Noise Control Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of federal research and activities in noise control, authorizes the establishment of federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products. The Act authorizes and directs that federal agencies, to the fullest extent consistent with their authority under federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 U.S.C. 4901. Each department, agency, or instrumentality of the executive, legislative and judicial branches of the federal government having jurisdiction over any property or facility or engaged in any activity resulting, or which may result in, the emission of noise shall comply with federal, state, interstate, and local requirements respecting control and abatement of environmental noise.
Occupational Safety and Health Act of 1970 (29 U.S.C. 659-678)	The Occupational Safety and Health Act was established to assure safe and healthful working conditions for working men and women by: authorizing enforcement of the standards developed under the Act; by assisting and encouraging the states in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes.
Pollution Prevention Act of 1990	The Pollution Prevention Act establishes that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and that disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.
Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.)	The Resource Conservation and Recovery Act gives the U.S. Environmental Protection Agency the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. The Act also sets forth a framework for the management of non-hazardous wastes.
State Regulation	**Activity or Requirement**
California Coastal Act of 1976	The California Coastal Act provides long-term protection of California's 1,100-mile coastline for the benefit of current and future generations. Coastal Act policies constitute the standards used by the Coastal Commission in its coastal development permit decisions and for the review of local coastal programs prepared by local governments and submitted to the Commission for approval. These policies are also used by the Commission to review federal activities that affect the coastal zone.

State Regulation	Activity or Requirement
Clean Air Act of 1988	The Clean Air Act develops and implements a program to attain the California Ambient Air Quality Standards for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter less than or equal to 10 microns in diameter, lead, sulfates, hydrogen sulfide, and vinyl chloride. 40 CFR Part 51 gives state and local agencies the authority to establish air quality rules and regulations. Rules adopted by the local air pollution control districts and accepted by the Air Resources Board are included in the State Implementation Plan. When approved by the U.S. Environmental Protection Agency, these rules become federally enforceable.
Porter-Cologne Water Quality Control Act	Protects all waters of the state for the use and enjoyment of the people of California and declares that the protection of water resources be administered by the regional water quality control boards.
California Integrated Waste Management Act of 1989, California Assembly Bill AB 939	Provides for the proper management and disposal of solid wastes, to include the diversion requirements for construction and demolition debris.

Chapter 2. Description of the Proposed Action and Alternatives

This chapter describes the Proposed Action, the No-Action Alternative, and other identified Alternatives. The chapter provides detailed descriptions of equipment needs, construction requirements, and operational parameters, for the restoration of San Antonio Creek under the Proposed Action. These descriptions are based on the *San Antonio Creek Stream Restoration, Basis of Design Report*, dated February 22, 2008 (HDR 2008).

2.1 Proposed Action (Alternative A)

Under the Proposed Action, approximately 0.875 mi of San Antonio Creek, between Hwy 1 and the Lee Road Utility Bridge (Figure 2-1), would be restored to protect creek banks from erosion and potential failure, and to maintain a desired streambed elevation to reduce channel erosion and promote channel stability. These measures would also increase in-stream habitat and improve water quality.

The specific objectives of this restoration project are to:

- Protect local infrastructure.
- Provide grade stabilization and prevent further channel lowering (degradation).
- Prevent migration of channel bottom headcuts through the restoration area.
- Reduce the potential for undermining the Lee Road Utility Bridge structure.
- Decrease water velocity and shear stress during flood events by increasing flow area at bends within the restoration area.
- Provide habitat diversity by restoring historical flood terraces within the restoration area.
- Increase the quality of suitable habitat within the restoration area for the federally endangered unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), the federally threatened California red-legged frog (*Rana aurora draytonii*), and other wildlife species.
- Stabilize the creek bank in key areas.
- Reduce erosion and quantity of sediment delivered to downstream wetlands.

The restoration would entail constructing two integrated components within San Antonio Creek:

1) ***In-stream rock-riffle grade controls at seven sites***. Grade controls are designed to stabilize channel invert. The National Cooperative Highway Research Program Report 544, *Environmentally Sensitive Channel- and Bank- Protection Methods* (Transportation Research Board 2005), identifies in-stream rock-riffles as an "environmentally sensitive" method of grade control. Rock riffles would prevent aggressive bed degradation from occurring, and arrest existing headcuts from continuing upstream.

2) ***Bioengineering bank stabilization at three of the grade control sites.*** This includes:

- *Longitudinal Peak Stone Toe Protection* - consisting of continuous protection at the toe of the embankment, allowing stone to self adjust into scour holes that may form.
- *Live Siltation* – consisting of live branch cuttings at the toe of the slope, extending below the seasonal saturation zone, and angling toward the creek channel. This method adds strength to the toe, increases bank roughness that encourages sediment deposition and reduces bank erosion, provides vegetative cover, and creates riparian habitat.
- *Floodplain Terraces* - appropriate where the natural floodplain has been cut off from the channel due to incision of the channel

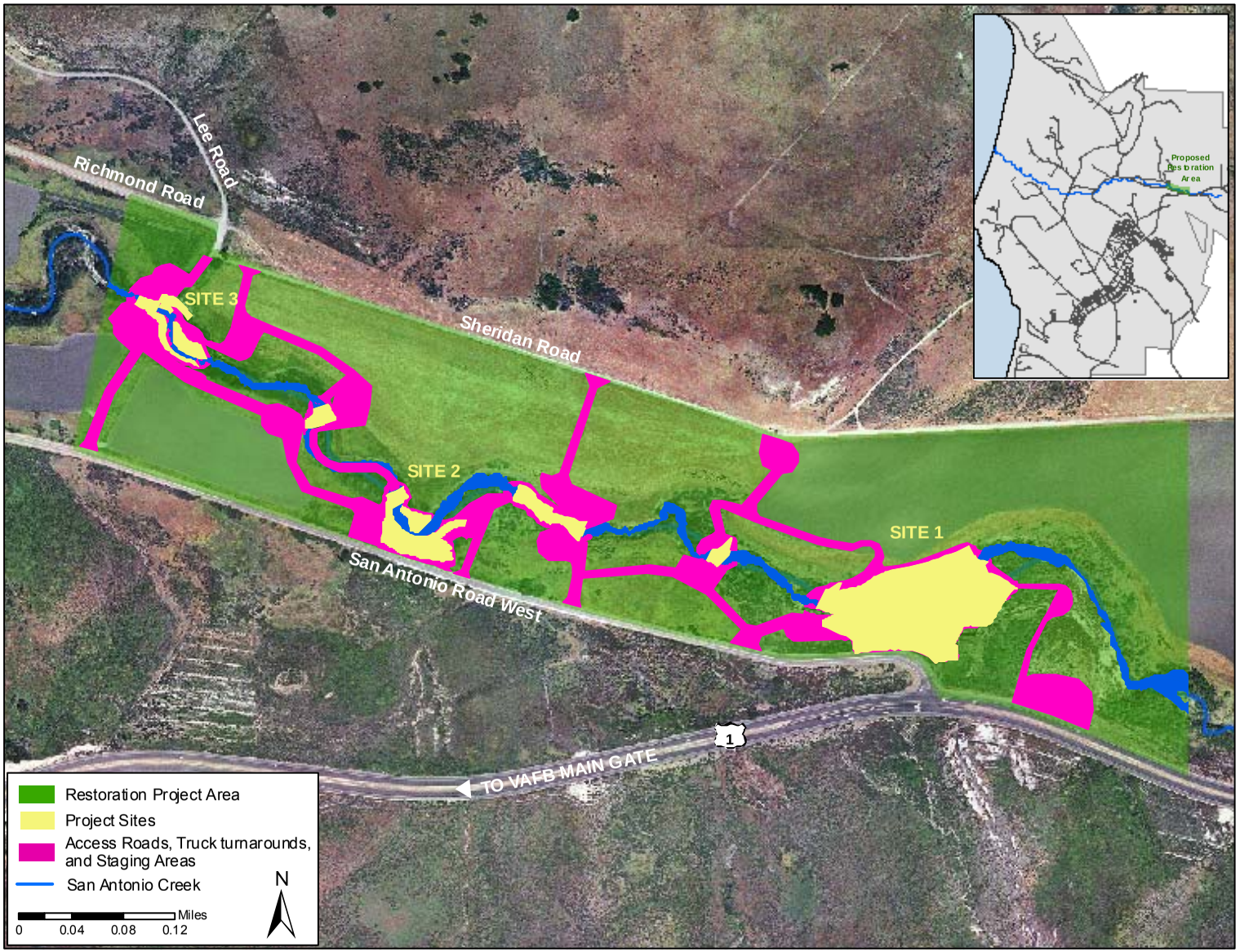

Figure 2-1. Proposed restoration sites.

over time. Recreated floodplain terraces dissipate energy during high creek flows, creating floodwater and sediment storage areas, and increasing conveyance capacity. These terraces should reduce pressure from the southern bank, where erosion susceptibility is high.

Engineering plan views of these structures and typical details are depicted in Appendix A. The estimated total project area is 127.84 acres.

2.1.1.1 Temporary Construction Access Roads, Staging Areas, and Operations within the Creek Bed

Temporary access roads would be constructed throughout the restoration area to access and deliver construction materials to project sites (Figure 2-1). These access roads would range from approximately 200 to 800 ft in length, and have a 15-foot wide base.

Areas for equipment turn-around and staging of materials would be located adjacent to the access roads. Construction materials to be stockpiled in these areas include excavated soil, stone aggregates, and rock riprap. An existing graded area located on the westbound shoulder of Hwy 1, east of San Antonio Road West, would also be used for staging equipment and materials. The rock would be placed individually to ensure a stable surface that provides protection for the creek bed and banks. A crane would place rock from the top of the embankment when possible. An excavator would operate from the creek bed and banks to place the remainder of the rock.

Existing vegetation (mostly disturbed Central Coast Scrub dominated by coyote brush [*Baccharis pilularis*]) would be removed to clear access roads and staging areas. Vegetative material would be processed into smaller pieces, and incorporated into mulch for use within the project area. To the extent feasible, vegetation would be removed mechanically. Large woody vegetation would be hand cleared within sensitive cultural resources areas, leaving root systems intact. Smaller vegetation would be crushed during construction of the roads and staging areas.

Access roads and staging areas would be graded and compacted where required. Woven geotextile fabric would be laid out, and a 6- to 8-inch thick layer of small diameter rock placed on top to prevent soil compaction and increase stability, if needed. The rock and geotextile fabric would be removed upon completion of the project. To the maximum extent feasible, all temporary access roads and staging areas would be restored to their original condition.

2.1.1.2 Containment of Creek Flow

Temporary containment of the active creek channel would be necessary to ensure unimpeded flow and prevent flowing water from flooding excavation sites. Impounding the channel upstream of a project site boundary, and installing 4- to 6-inch corrugated plastic pipes, would allow active flows to pass through or around the project site. Screening would be placed at the intake of the water diversion pipes. Velocity dissipation would be provided at the outfall where the diverted creek is returned to its natural channel. Containment of the creek flow during work at each specific site would occur for a limited amount of time, until all equipment operations below the 2-year water elevation is complete (approximately 3 to 7 days per site). After completing project activities, the temporary pipes would be capped-off and remain buried in place.

2.1.1.3 Excavated Soil

The most desirable growth medium for native plants is native topsoil containing site-adapted seeds and microorganisms that contribute to the long-term establishment of revegetation plantings. Native topsoil and subsoil would be salvaged during excavation and grading, except in areas with a seed bank likely dominated by undesirable weed species. Soil excavated within the project area would be used as fill within project sites. Excess material would be transported to a designated waste or fill site.

2.1.1.4 Branch Cuttings

Biotechnical soil stabilization is a construction method that uses vegetative material and structural components in a mutually reinforcing manner. Biotechnical plantings would be incorporated during construction to provide geotechnical strength, improved habitat, enhanced aesthetics, and promote rapid revegetation. Willows (*Salix* spp.), the dominant riparian tree species within the project area, and other species native to the San Antonio Creek watershed that propagate rapidly from cuttings, would be used for biotechnical stabilization and bioengineering. To maintain genetic integrity, cuttings would be collected from species growing within the project area. If additional cuttings are needed, collection would occur within approximately 22.35 acres of willow riparian habitat near the El Rancho Lateral Road-Lompoc Casmalia Road intersection (Figure 2-2).

Live branch cuttings, predominantly willow, would be separated into two categories: branches (6 to 10 ft), and poles (greater than 10 ft). Branch cuttings would be used for live siltation and horizontal brush-layering techniques, arrayed depending on their desired function and site condition. Poles would be used to vegetate rock riprap. Table 2-1 lists native plant species planned for use in pole and bundle plantings. This list comprises the majority of arboreal species occurring naturally within the VAFB portion of the San Antonio Creek watershed (Keil and Holland 1998). Branches would be conservatively collected so the parent plant is not compromised.

Branches and poles would be collected using chain or handsaws. Cuttings would be collected at least 24 hours prior to planting, and soaked until planted. Live branch materials would be watered-in after installation.

Table 2-1. Native plant species to be collected for pole and branch plantings.

Scientific Name	Common Name
Populus balsamifera ssp. *trichocarpa*	Black cottonwood
Salix laevigata	Red willow
Salix lasiolepis	Arroyo willow
Salix lucida ssp. lasiandra	Shining willow
Sambucus mexicana	Blue elderberry

2.1.1.5 Restoration of Vegetation Types

Areas disturbed by construction activities would be restored to an ecologically functional state that supports the same local plant and animal species found in adjacent natural areas. Native species were selected on the basis of providing conditions that facilitate soil deposition, nutrient cycling, plant succession, natural regeneration, wildlife movement, and erosion control.

All disturbed soil areas above the ordinary high water mark (OHWM) would receive a standard treatment that includes:

- Soil preparation, including surface roughening and tracking with mechanical equipment, to catch seed, fertilizer and mulch, and decrease runoff.
- Soil amendments, including mycorrhizae inoculum, organic fertilizer (Biosol® Mix 7-2-3 or equivalent), and a 2-inch layer of compost (if needed) to rebuild soil nutrients and biological soil structure, encourage native plant succession, and discourage invasive plant species.
- A seed mix and weed-free straw mulch for temporary cover, to aid in the establishment of vegetation. If necessary, a tackifier would be hydraulically applied to anchor the straw mulch.

Habitat specific seed mixes would accommodate for species variation within different vegetation types, with a combination of shrub, perennial, and annual species. Table 2-2 lists seed mixes that would be used in revegetation efforts for riparian and upland vegetation types. These commercially

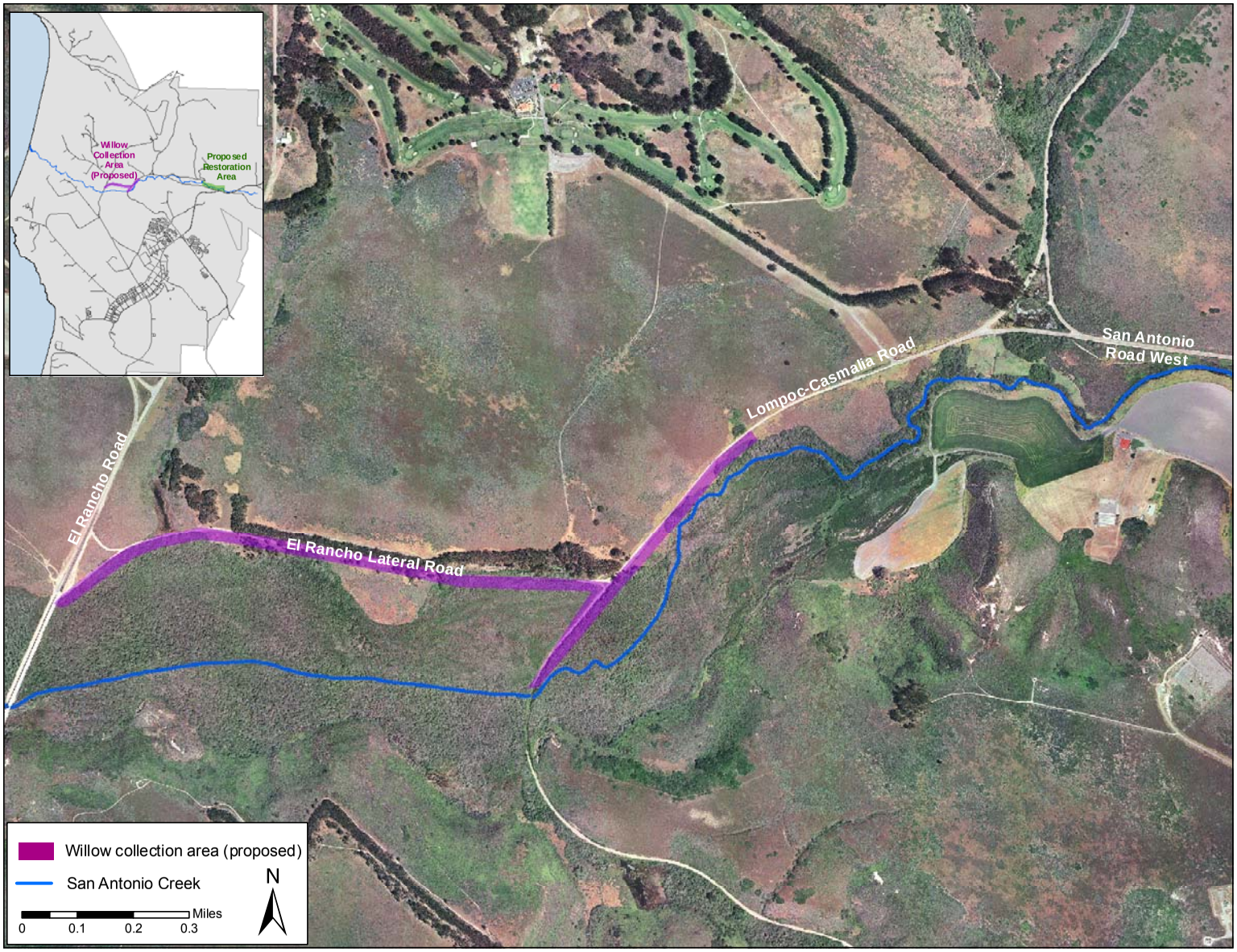

Figure 2-2. Area proposed for willow collection outside the boundaries of the Proposed Action.

Table 2-2. Native seed mixes to be used in revegetation efforts.

Common Name	*Scientific Name*	Application (lbs/acre)
Riparian		
Mugwort	*Artemisia douglasiana*	2
Mulefat	*Baccharis salicifolia*	2
Umbrella sedge	*Cyperus eragrostis*	1
Meadow barley	*Hordeum brachyantherum*	8
Creeping wild rye	*Leymus triticoides*	10
Small fescue	*Vulpia microstachys*	3
Upland		
Coyote bush	*Baccharis pilularis*	3
California brome	*Bromus carinatus*	5
California poppy	*Eschscholzia californica*	1
Toyon	*Heteromeles arbutifolia*	2
Goldfields	*Lasthenia glabrara*	1
Giant wild rye	*Leymus condensatus*	3
Dove lupine	*Lupinus bicolor*	3
Lompoc monkey flower	*Heteromeles arbutifolia*	2
Purple needlegrass	*Nassella pulchra*	5
Branching phacelia	*Phacelia ramosissima*	2
Blue elderberry	*Sambucus mexicana*	1
Western vervain	*Verbena lasiostachys*	2

available mixes were selected based on species reported in *Alternative Analysis Report San Antonio Creek Crossing Alternatives, Vandenberg Air Force Base, Volumes I and II* (USACE 1998), and *San Antonio Creek Short-term Flood Control Draft EA* (Tetra Tech 1997); and on information gathered during site visits conducted in 1998 by Aspen, and in 2005 and 2008 by ManTech SRS Technologies, Inc. (MSRS). It is anticipated that salvaged soils would also contain a seed bank, which would eventually increase species density and diversity. Seed mixes would be applied by uniformly spreading the seed mix by hand, and would be limited to the species and quantity specified in the seed mix.

In addition, *Juncus* spp. and *Carex* spp. divisions would be salvaged from the project area, or collected from Barka Slough (Figure 1-2), and planted in disturbed soil areas within the 2-year floodplain.

2.1.1.6 Granular Filter

In lieu of standard geotextiles, a 12-inch layer of granular filter, composed of a graded aggregate, would be used where appropriate, to encourage root establishment and biotechnical slope stabilization. Approximately 1,815 cubic yards (yd^3) of granular filter would be used during project implementation.

2.1.1.7 Project Equipment Needs

Table 2-3 provides the estimated types of equipment that would be used for the proposed project. Although the exact type of equipment may vary slightly from these projections, these estimates provide a sound basis for analyzing related issues, such as air quality.

Table 2-3. Equipment needs for creek restoration.

Equipment	Task Description
Excavator	Excavate and place rock
Loader	Place materials
Chipper/Mulcher	Mulch
Water Truck	Provide portable water
Dump Trucks	Deliver materials
Road Grader	Clear access
Dozer	Grade
Compactor	Compact soil
Forklift	Unload materials
Crane	Move and place rock
Chainsaw	Remove vegetation
Crew truck	Transport workers to site

2.1.1.8 Construction Requirements

Implementation of the proposed restoration project would last approximately 7 to 10 weeks. Construction activities would begin approximately August 25, 2008, and end October 15, 2008. If rains begin prior to project completion, activities would resume in the spring of 2009. Project activities would occur within 8- to 10-hour workdays, and 5- to 6-day workweeks. Two teams of approximately six workers and a construction supervisor would participate in construction activities. However, at any one time, approximately 30 to 40 personnel could be present working on different aspects of the restoration. Traffic on San Antonio Road West would be restricted to one lane within the project area for approximately 15 days.

2.1.1.9 Grade Controls

Rock-riffle grade controls would be installed at seven locations in San Antonio Creek from just below bank stabilization Site 1 (see description below) to just below the Lee Road Utility Bridge, with a typical spacing of 500 to 930 ft (Figure 2-1). The locations and elevations for these structures were selected based on the anticipated future channel profile, and to tie into bank stabilization sites. Access to all grade control structures would be restricted to designated access routes (Section 2.1.1.1) originating from Sheridan Road, San Antonio Road West, and Lee Road.

Grade control structure No. 1 is particularly important because, if left in its existing condition, the channel bed downstream of the improvements would be free to degrade. This grade control structure would prevent any headcuts, or general channel bed degradation, from advancing upstream. In addition, three sites proposed for bank stabilization (see descriptions below) would be keyed in at the downstream end to grade control structures, to provide long-term degradation scour protection for the sites.

Non-woven geotextile fabric and a 6-inch layer of rock bedding would be placed within the footprint of each grade control structure to prevent it from settling and becoming ineffective. Large diameter stone (one-half to 8-ton class) would be embedded from 3 to 10 ft into the creek bed and banks, creating a 3- to 9-foot deep layer that will allow the creek to reach its “equilibrium slope,” and also allow local scour pools to form downstream of the structures. Rock would be placed in compression from downstream to upstream at a 20H:1V (horizontal:vertical) slope, and each structure would have a crest no more than 4 ft higher than the existing creek bed. The creek bed would eventually become level with the crest as sediment is trapped behind it. Fish ladder pools will be incorporated into the downstream slope of the structures to allow fish passage and enhanced aquatic habitat. Pools formed upstream of the crest would provide habitat in low flow conditions.

Rock keys would be constructed at the upstream end of each grade control, from 3 to 9 ft into the existing bank, up to the 100-year flood level, to prevent possible flanking of the structures during peak runoff events. Rock keys would extend up to 20 ft on the creek banks with a 1.5H:1V maximum grade.

Grade control structures would range from 60 to 170 ft in length. For each structure, approximately 1,500 yd^3 of soil would be

excavated within the creek bed and banks, and replaced with 4,000 tons of rock.

Pole plantings of live willow branches would be placed at the toe of the slope and upstream of the rock keys, and integrated during rock placement to add strength, trap sediment, and create riparian habitat. After placement of the rock riprap, sand and gravel would be placed over each grade control structure to fill in voids. Detailed illustrations of grade control structures are presented in Appendix A, Sheet 8.

2.1.1.10 Bank Stabilization Site 1

Site 1 is located immediately west of the Hwy 1-San Antonio Road West intersection, on the north side of the latter (Figure 2-1). San Antonio Creek has eroded to near vertical at the toe of the embankment at this site. The overall height of the slope is approximately 85 ft between the road surface and the streambed elevation (HDR 2008). San Antonio Road West is constructed on embankment fill within this site.

Improvements at Site 1 are designed to provide 100-year flood protection for the south bank of San Antonio Creek, near San Antonio Road West. Bank stabilization would be accomplished by installing a living dike system (to redirect the creek thalweg); bank protection; and a vegetated longitudinal peak stone toe (to prevent flanking of the bank protection on the south bank of San Antonio Creek). A point bar on the north bank would be graded, with a terrace at the 2-year flood elevation, and another at the 5-year flood elevation. The increased cross-sectional area, and cover and geotechnical strength provided by the biotechnical plantings, would reduce channel bank erosion, improve natural stream function, and enhance riparian habitat. Access to Site 1 would be restricted to routes (Section 2.1.1.1) originating from Hwy 1, San Antonio Road West, and Sheridan Road (Figure 2-1). The improvements proposed for Site 1 are illustrated in Appendix A, Sheet 5.

Living Dikes

A living dike system would be used to redirect creek flows away from the current reach and into a new low flow channel. This new 25-foot wide channel would be graded 30 to 160 ft north of the eroded south bank, redirecting approximately 600 ft of San Antonio Creek. The living dike system would consist of three trenches excavated approximately 2 to 3 ft deep, with willow poles planted in each, and backfilled with the excavated soil. One trench would extend 300 ft on the south bank, parallel to the redirected creek flow. Two additional trenches, 120 ft in length, would extend perpendicular to the redirected creek flow on the south bank, to the tie-back on the existing creek bank. An additional impoundment would be installed for willow storage during project implementation and would be removed upon completion of the project.

Bank Protection

The top of the existing embankment would be graded at a 2 percent minimum grade to drain toward San Antonio Road West. Approximately 6,660 yd^3 of soil would be excavated from the top of the existing slope with a staggered cut to key into the slope. Compacted fill material (approximately 44,000 yd^3) excavated from the project site would be used to rebuild approximately 500 linear feet of the south creek bank to a 2.25H:1V slope. The area would be cleared of existing vegetation and scarified prior to placement of fill.

Granular filter would be placed to secure the soil fill. The bank would be armored with a 3.4-foot layer of vegetated rock riprap up to the 100-year flood level (15 ft vertically) for stability. Approximately 3,200 tons of one-half ton rock would be placed along the creek bank at this site. Pole plantings would be integrated behind the riprap protection during rock placement. Poles would be laid on the bank extending below the seasonal saturation zone, with the tips bent to a vertical position through the riprap, creating a dense and continuous vegetative cover (commonly referred to as the bent pole method). Once

established, root systems of these trees would help to bind the creek bank in place, providing additional bank stabilization, and establishing vegetative growth within the rock. The rock would be soil filled and the area revegetated (see Section 2.1.1.5).

A stone toe would be constructed along the realigned south creek bank (500 ft) to protect against bend scour, and provide a stabilized foundation for installing willow cuttings. Approximately 1,650 yd^3 of soil would be excavated from the existing creek bed and bank to place 3,000 tons of one-half ton rock on a 1.5H:1V slope. Granular filter would be placed below the riprap. The rock would have a parallelogram cross section, with a vertical height of 9 ft, extending 5 ft below the creek bed and 4 ft above, and a 12-foot horizontal base.

Live siltation would be placed in between the toe of the slope and the longitudinal stone toe protection. The downstream end of the bank protection would be contiguous to a grade control structure. These structures would provide long-term degradation scour protection for this site.

Longitudinal Peak Stone Toe Protection

Longitudinal peak stone toe protection would be installed approximately 280 ft upstream of the south creek bank protection. Rock would be placed on a granular filter following the old creek bed alignment, forming a triangular cross section of riprap with 1.5H:1V side slopes, a peak extending up to the 5-year flood level (4 ft in height), and a 12-foot horizontal base. Live siltation would be placed on the south face of the longitudinal peak stone toe. The pole bundles and area between the south creek bank and stone toe would be backfilled with approximately 830 yd^3 of soil. This area would be revegetated as described in Section 2.1.1.5.

Approximately 12 yd^3 of soil would be excavated from the embankment to tie-back the longitudinal peak stone toe into the creek bank. The pole bundles and area between the south creek bank and longitudinal peak stone toe would be backfilled with riprap, and embedded into the creek bank a minimum of 3 ft. The riprap would also be keyed in to the creek bank a minimum of 5 ft at the upstream and downstream ends. An estimated 500 tons of one-half ton rock would be used for the longitudinal peak stone toe and its tie-backs.

Floodplain Terrace

Approximately 580 linear feet of the creek bed would be excavated to create a new low flow channel, 20 to 25 ft in width. The north creek bank would be excavated to create a floodplain terrace at the 2-year and 5-year water surface elevations. A 2H:1V slope would be excavated above the 5-year floodplain terrace to the top of the embankment. In addition, a slope would be graded between the low flow channel and the living dike system. Approximately 40,100 yd^3 of soil would be excavated from the new creek bed and north bank. The area would be revegetated as described in Section 2.1.1.5.

Guardrails

The existing guardrail on the westbound shoulder of San Antonio Road West would be extended to provide public protection from the steep embankment near the roadway. Metal beam guardrails, with wood posts and blocks, would be installed 170 ft at the west end and 70 ft at the east end of the existing guardrail. A 1-foot square area would be excavated to a depth of 3 to 4 ft to install each wood post.

2.1.1.11 Bank Stabilization Site 2

Site 2 is located adjacent to the westbound shoulder of San Antonio Road West, approximately 2,000 ft west of Hwy 1 (Figure 2-1). Approximately 120 ft of the north bank at this site is armored with concrete rubble inclined at approximately 1.5H:1V. A concrete ditch located along the eastbound shoulder of San Antonio Road West, and a cross culvert, discharge onto the armored portion of the slope. The height of the creek bank is approximately 35 ft between the road surface and the streambed elevation (HDR 2008).

Improvements at Site 2 are designed to stabilize the existing slope, and improve the function of the north overbank. The protection consists of a vegetated longitudinal peak stone toe; vegetated mechanically stabilized earth (VMSE) fill slope; floodplain terrace; and construction of a rock swale for an existing corrugated metal pipe (CMP) outfall. Access to Site 2 would be restricted to designated routes (Section 2.1.1.1) originating from San Antonio Road West and Sheridan Road (Figure 2-1). The improvements proposed for Site 2 are illustrated in Appendix A, Sheet 6.

Longitudinal Peak Stone Toe Protection

Approximately 200 ft of San Antonio Creek would be redirected 25 ft north, away from the eroded south bank, to improve the channel planform and stream function. To protect against bend scour, a longitudinal peak stone toe would be constructed along approximately 410 linear feet of the south creek bank, below the existing concrete rubble and the adjacent upstream creek bank. Stone protection is required to prevent bank erosion where creek flows directly impinge on this bank. In addition, it would stop the migration of the creek towards San Antonio Road West, preventing its eventual collapse at this site. The longitudinal peak stone toe would also provide a stable foundation for establishing willow vegetation with live siltation.

Approximately 1,000 yd^3 of soil would be excavated from the creek bed and banks to place rock riprap. A granular filter would be placed in the toe, and 2,460 tons of large diameter rock placed on top, along the bank, to form a 1.5H:1V slope. The rock would be embedded approximately 5 ft below the creek bed, and extend 12 ft toward the creek channel. Rock riprap would be placed up to the 2-year flood level (4 ft) on the south creek bank.

The stone toe would be keyed in upstream a minimum of 5 ft at two levels (the 5-year and 100-year flood levels) to prevent flanking of the riprap. The downstream end of the rock protection would be tied into a grade control structure, providing general scour protection for the site.

Live siltation would be placed on the south face of the stone toe protection. In addition, pole plantings would be integrated during rock placement and bent up through the riprap to create a dense and continuous vegetative cover.

Vegetated Mechanically Stabilized Earth

Protruding rebar present in the existing concrete rubble on the south creek bank would be trimmed, and the rubble choked with approximately 2,700 yd^3 of sand. Sand would be imported to the project site unless a large quantity of suitable material is available within the project area. Approximately 300 linear feet of the south creek bank would be rebuilt to a 2H:1V slope with an additional 5,700 yd^3 of fill material excavated from the project site.

Live willow branches would be layered (brushlayering) in lifts with compacted soil as the slope is constructed, up to the 100-year flood level. Coir netting would be rolled out over each lift and slope face, to act as an erosion control blanket until vegetation can be established, and to confine the soil between the layers of live vegetative material, creating a vegetated retaining wall. The area above the soil lifts would be revegetated as described in Section 2.1.1.5.

Floodplain Terrace

The north creek bank would be excavated to create a new 20 to 25 ft wide, 160 ft long, low flow channel, and floodplain terrace at the 2-year flood level elevation, with a 2H:1V slope from above this terrace to the 100-year flood level. Approximately 8,600 yd^3 of soil would be excavated on the north creek bank. The area would be revegetated as described in Section 2.1.1.5.

Rock Swale

A rock swale would be constructed to carry surface flows from an existing 30-inch diameter CMP installed beneath San Antonio Road West, down the south embankment, to the longitudinal peak stone toe protection. A 3.5-foot layer of large diameter rock

(approximately 230 tons) would be embedded into the VMSE, on top of a granular filter, to create a rock swale approximately 16 ft wide and 75 ft long. The rock would be soil filled and the area would be revegetated (as described in Section 2.1.1.5).

Guardrail

A 270 ft long metal beam guardrail with wood posts and blocks would be installed on the westbound shoulder of San Antonio Road West to provide public protection from the steep embankment near the roadway. A 1-foot square area would be excavated to a depth of 3 to 4 ft to install each wood post.

2.1.1.12 Bank Stabilization Site 3

Site 3 is located approximately 1,400 ft downstream from Site 2, where the Lee Road Utility Bridge crosses San Antonio Creek (Figure 2-1). Along the northern abutment of the utility bridge, the creek is armored with gabions (a cylindrical framework filled with rocks); the southern abutment is armored with rock slope protection. The creek banks are inclined at approximately 1.5H:1V, and are approximately 30 ft high between the road surface and the streambed elevation (HDR 2008).

Improvements at Site 3 are designed to prevent flanking of the existing rock riprap on the southern bridge abutment approach. Bank stabilization would consist of installing a vegetated longitudinal peak stone toe with live siltation, and grading a floodplain terrace. In addition, rock riprap that has fallen into the creek channel would be removed and placed as part of the toe. Access to Site 3 would be restricted to designated routes (Section 2.1.1.1) originating from Lee Road and Sheridan Road (Figure 2-1). The improvements proposed for Site 3 are illustrated in Appendix A, Sheet 7.

Longitudinal Peak Stone Toe Protection

Stabilization of the southern creek bank at Site 3 would include installing rock riprap along 150 ft at the toe of the slope, upstream of the existing riprap. Approximately 330 tons of one-half ton rock placed on the creek bed would form a 1.5H:1V cross section of riprap, 5 ft in height, with a 12- to 15-foot horizontal base. Live siltation would be placed on the south face of the stone toe protection. The live siltation and the area between the south creek bank and stone toe would be backfilled with approximately 180 yd^3 of soil. Granular filter would be placed below the rock and soil fill.

In addition, 74 yd^3 of soil would be excavated and replaced with 151 tons of 4-ton rock to key the stone toe protection into the south creek bank and prevent flanking of the riprap. Geotextile fabric and rock bedding would be placed below the rock keys for stabilization. The stone toe would be keyed in upstream a minimum of 5 ft into the creek bank, and to the 5-year flood level. The downstream end of the toe protection would be keyed along 10 ft, approximately 7 ft into the creek bank, and tied into the existing rock riprap bank protection. The stone toe would provide a stabilized transition to the existing rock riprap on the south bank. A grade control structure located downstream of the Lee Road Utility Bridge would tie into the existing rock riprap and gabion protection, providing long-term degradation scour protection for this site.

Revegetation of Existing Bank Protection

The existing rock riprap on the south creek bank (approximately 0.1 acre) and wire gabions on the north creek bank (approximately 0.2 acre), adjacent to the utility bridge, would be filled with a graded aggregate or fill material excavated from the project site, receive a 1-foot soil and mulch layer, and revegetated (see Section 2.1.1.5). Where possible, pole plantings would be incorporated into the bank protection.

Floodplain Terrace

The north creek bank would be excavated to create a terrace at the 2-year flood level, and a 2H:1V slope above this terrace up to the 5-year flood level. Approximately 2,900 yd^3 of soil would be excavated from the north creek bank.

2.1.2 Post-Construction Monitoring and Maintenance

Post-construction monitoring to assess the effectiveness of initial revegetation efforts, and provide guidance for follow-up maintenance, would occur for a period of 5 years. Monitoring would focus on the extent of native species cover and diversity.

Planted areas would be maintained, as required, to ensure the National Pollutant Discharge Elimination System (NPDES) Construction General Permit termination requirements are met. Non-native invasive plant species within the restoration area would be eradicated to ensure successful establishment of native species. It is anticipated that monitoring and eradication of invasive plant species would be necessary throughout the post-construction monitoring and maintenance period.

2.2 Alternative B: No-Action Alternative

Under the No-Action Alternative, none of the restoration and bank protection measures described under the Proposed Action would be implemented within San Antonio Creek.

Because the banks of San Antonio Creek would continue to be unprotected, they would be subject to further erosion by future storm flows. Over time, the south bank of San Antonio Creek would continue to migrate toward San Antonio Road West, eventually undermining the roadway and forcing the closure of the road.

The loose concrete rubble placed during the 1998 emergency repairs on the south bank, adjacent to San Antonio Road West, and around footings of the Lee Road Utility Bridge, would remain without any additional reinforcement. Because the toe of the slope has not been reinforced below the surface, it would be subject to erosion by future storm flows. Eventually, this could undermine the loose rock and rubble supported on the slope above. Areas adjacent to these slopes would continue to be threatened by the eroding and undercutting of the watercourse. As a result, the emergency protection to the creek bank and bridge abutments could be undermined and fail during future major creek flows, undermining the roadway and threatening the bridge structure.

2.3 Other Alternatives Considered and Eliminated from Further Analysis

Natural and cultural resource concerns precluded the consideration of the alternatives discussed in this section. EO 11990, *Protection of Wetlands,* prevents the Air Force from approving projects if there are “practicable” or reasonable alternatives to impacting wetlands.

2.3.1 Alternative C

Under Alternative C, fill material would be used to restore the south bank of San Antonio Creek and rock riprap would be used to act as an embankment revetment to prevent future erosion. A Draft EA underwent public review in February 1999 (USACE 1999). Potential significant impacts to biological resources due to a permanent loss of riparian habitat eliminated further consideration of this alternative.

2.3.2 Alternatives D through G

In 2002, the 30th Civil Engineer Squadron (30 CES) contracted a study (Tetra Tech 2002) to recommend more environmentally friendly design alternatives to the previously proposed actions of the 1999 Draft EA. The study looked at erosion control, bank stabilization, and roadway alternatives in depth. Construction of a parallel channel was also considered. These alternatives are described in greater detail below.

2.3.2.1 Alternative D

Under Alternative D, the recommended approach at two sites was rock riprap for sloped areas, and gabions for vertical areas

within the zone below the 100-year flood level, referred to as the "flow zone." Live fascines (bundles of woody vegetation buried in trenches below the creek parallel to creek flow) would be used in sloped areas, and gabions in vertical areas of the zone above the 100-year flood level, referred to as the "no flow zone." At a third site, rock riprap or vegetated geogrids were recommended for the flow zone, and live fascines for the no-flow zone. This alternative would limit revegetation of the slope; therefore it was eliminated from further consideration due to the potential for significant impacts to biological resources.

2.3.2.2 Alternative E

Under Alternative E, the intersection of San Antonio Road West and Hwy 1 would be moved either east or west, realigning segments of the roadway further to the south at two sites. The roadway realignments would require stabilization of the creek banks but would allow flatter slopes and more opportunity for revegetation.

Excavation associated with these roadway realignments has the potential to adversely affect buried cultural resources recorded in this area. For this reason, Alternative E was eliminated from further consideration.

2.3.2.3 Alternative F

Alternative F proposed the construction of a new roadway to the north of San Antonio Creek and the removal of the existing roadway entirely from the path of future creek meandering. Alternative F would not allow for continued access from Hwy 1 to San Antonio Road West and the facilities along the road. For this reason, Alternative F was eliminated from further consideration.

2.3.2.4 Alternative G

Alternative G proposed bank stabilization and construction of a parallel, secondary channel at two sites north of San Antonio Creek, to divert peak flow away from the south banks. Although the parallel channel would likely improve the hydraulics of the main creek channel, and provide additional riparian habitat within the diversion channel, potential adverse impacts to existing wetlands could be significant. For this reason, Alternative G was eliminated from further consideration.

2.3.2.5 Alternative H

In November 2004, 30 CES proposed an alternative to realign San Antonio Road West parallel to and southwest of the existing road, with a new intersection at Hwy 1. Bendway weirs (low rock structures constructed at an upstream angle) would redirect creek flow away from the banks and provide new wetland habitat. This alternative was eliminated from further consideration due to the presence of cultural resources within the area and high construction costs.

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Chapter 3. Affected Environment

This chapter describes the existing environmental conditions near and within the proposed San Antonio Creek restoration area on VAFB that have the potential to be affected by the Proposed Action. The area considered for most resources was confined to the immediate area of the proposed restoration activities. As appropriate, for some environmental resources, a wider regional area was used.

3.1 Air Quality

Air quality is described based upon the concentration of pollutants in the atmosphere. These concentrations are expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The type and amount of pollutants emitted into the atmosphere, together with the size and topography of the air basin and the prevailing meteorological conditions, determine air quality. Comparing the concentration to state and federal ambient air quality standards assists with determining the significance of any particular pollutant concentration. These standards represent the maximum allowable atmospheric concentrations that may occur while still providing protection for public health and safety with a reasonable margin of safety.

The Clean Air Act (CAA) required the U.S. Environmental Protection Agency (EPA) to establish ambient ceilings for certain criteria pollutants. Subsequently, the U.S. EPA promulgated regulations that set the National Ambient Air Quality Standards (NAAQS). NAAQS have been established for carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter 10 microns or less in diameter (PM_{10}), particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Of these seven criteria pollutants, five are primary pollutants; emitted directly from a source. $PM_{2.5}$ is both a primary and secondary pollutant, and O_3 is a secondary pollutant, i.e., not directly emitted, but formed from the reaction of nitrogen oxides (NO_X) and reactive organic compounds (ROCs). The NAAQS are presented in Table 3-1.

Under the California CAA, California established air quality standards for the state, known as the California Ambient Air Quality Standards (CAAQS). CAAQS are generally more stringent than the NAAQS, and there are additional CAAQS for sulfates (SO_4), hydrogen sulfide (H_2S), vinyl chloride, and visibility reducing particulate matter. The CAAQS are also presented in Table 3-1.

The area affected by the emissions from the Proposed Action includes VAFB and the surrounding portions of Santa Barbara County. For CO, NO_2, PM_{10}, and SO_2, the affected area is generally limited to a few miles downwind of the emission source, while for O_3 it can extend many miles downwind. Because the reaction between ROCs and NO_Xs usually occurs several hours after they are emitted, the maximum O_3 level can be many miles from the source; therefore, the area affected by O_3 and its precursors produced by VAFB, could include most of northern Santa Barbara County. In addition, O_3 and its precursors transported from other regions can combine with local emissions to produce high, local O_3 concentrations.

3.1.1 Regional Climate and Meteorology

The climate at VAFB can be characterized as cool and wet from November through April and warm and dry from May through October. The average annual rainfall is approximately 14.7 inches, most of which falls between November and May (unpub. data, 30 SW). Winds are usually light during the nighttime

Table 3-1. Ambient air quality standards.

Pollutant	Averaging Time	CAAQS[1,3]	NAAQS[2,3]	
			Primary[4]	Secondary[5]
Ozone	8-hour	0.07 ppm (137 μg/m^3)	0.08 ppm (157 μg/m^3)	Same as Primary
	1-hour	0.09 ppm (180 μg/m^3)	--	
Carbon Monoxide	8-hour	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	None
	1-hour	20.0 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	
Nitrogen Dioxide*	Annual Arithmetic Mean	0.03 ppm (56 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as Primary
	1-hour	0.18 ppm (338 μg/m^3)	--	
Sulfur Dioxide	Annual Arithmetic Mean	--	0.03 ppm (80 μg/m^3)	--
	24-hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	--
	3-hour	--	--	0.5 ppm (1300 μg/m^3)
	1-hour	0.25 ppm (655 μg/m^3)	--	--
PM_{10}	Annual Arithmetic Mean	20 μg/m^3	--	Same as Primary
	24-hour	50 μg/m^3	150 μg/m^3	
$PM_{2.5}$	Annual Arithmetic Mean	12 μg/m^3	15 μg/m^3	Same as Primary
	24-hour	No State Standard	35 μg/m^3	
Sulfates	24-hour	25 μg/m^3	No Federal Standards	
Lead	30-day average	1.5 μg/m^3	--	--
	Calendar Quarter	--	1.5 μg/m^3	Same as Primary
Hydrogen Sulfide	1-hour	0.03 ppm (42 μg/m^3)	No Federal Standards	
Vinyl Chloride	24-hour	0.01 ppm (26 μg/m^3)	No Federal Standards	
Visibility Reducing Particles	8-hour	Extinction coefficient of 0.23 per kilometer – visibility of ten miles or more due to particles when relative humidity <70%.	No Federal Standards	

NOTES:

*The Nitrogen Dioxide ambient air quality standard was amended on February 22, 2007, to lower the 1-hr standard to 0.18 ppm and establish a new annual standard of 0.03 ppm. These changes become effective after regulatory changes are submitted and approved by the Office of Administrative Law.

(1) California Standards for ozone, carbon monoxide, sulfur dioxide (1- and 24-hour), nitrogen dioxide, PM_{10}, $PM_{2.5}$, and visibility reducing particles are not to be exceeded. Sulfate, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.

(2) National Standards, (other than ozone, particulate matter, and those based upon annual averages or average arithmetic means) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three-years, is equal to or less than the standard. For PM_{10}, the 24-hours standard is attained when 99% of the daily concentrations, averaged over three years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hours standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or less than the standard.

(3) Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature and pressure of 25 degrees Celsius (^{O}C) and 760 millimeters of mercury (mm Hg), respectively. Most measurements of air quality are to be corrected the reference temperature of 25 ^{O}C and reference pressure of 760 mm Hg; ppm in this table refers to ppm by volume or micromoles of pollutant per mole of gas.

(4) National Primary Standards: The level of air quality necessary, with an adequate margin of safety to protect the public health.

(5) National Secondary Standards: The level of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

hours, reaching moderate speeds of approximately 12 miles per hour (mph) by the afternoon. Winds are most often northwesterly on north Base and north to northeasterly on south Base. The strongest winds are associated with rainy season storms.

VAFB is subject to early morning and afternoon temperature inversions about 96 and 87 percent of the time, respectively. In an inversion, air temperature rises with increasing altitude, which confines the surface air and prevents it from rising. This restricts the vertical dispersion of pollutants and, therefore, increases local pollutant concentrations. Pollutants are "trapped" under an inversion layer until either solar radiation produces enough heat to lift the layer or strong surface winds disperse the pollutants. In general, these conditions occur most frequently during the nighttime and early morning hours.

3.1.2 Existing Air Quality

The U.S. EPA classifies air quality within each air quality control region with regard to its attainment of NAAQS. The California Air Resources Board (CARB) does the same for CAAQS. An area with air quality better than state or federal ambient air quality standards for a specific pollutant is designated as attainment for that pollutant. Any area not meeting those standards is classified as non-attainment. Santa Barbara County is in attainment or unclassified for all the ambient air quality standards except for the state standards for PM_{10} and O_3. Santa Barbara County went into attainment for Federal Ozone in 2003 and governed by an approved Maintenance Plan as part of the California State Implementation Plan.

The estimated emissions for Santa Barbara County and VAFB are presented in Tables 3-2 and 3-3. In Table 3-2, the Santa Barbara County emissions are 2002 daily planning emissions taken from the 2007 Santa Barbara County Air Pollution Control District (SBCAPCD) Clean Air Plan, while the VAFB emissions are annual emissions taken from the *2001 Comprehensive Emission Inventory Draft Report*.

Table 3-2. Existing emissions.

Source	2002 Emissions			
	Annual (Tons/Year)		Planning Day (Tons/Day)	
	NO_x	ROC	NO_x	ROC
Santa Barbara County	*16,155.94*	*43,439.57*	*41.2055*	*40.8432*
Stationary Sources	2,468.61	3,210.78	6.1160	9.3072
Area-Wide Sources	412.42	3,731.71	0.6326	9.9218
Mobile Sources	12,412.43	7,888.88	33.9613	21.6142
Natural Sources		28,608.20		882.4800
Outer Continental Shelf Sources	*14,324.89*	*3,499.34*	*39.2558*	*3.8761*
Stationary Sources	305.16	425.88	0.8361	1.1667
Mobile Sources	14,019.73	994.56	38.4197	2.7094
Natural Sources		2,078.90		
Total	***30,480.83***	***46,938.91***	***80.4613***	***44.7193***
VAFB Annual	***1,134***	***229***	***ND***	***ND***

ND = Not determined

SOURCE: 2007 Clean Air Plan, Santa Barbara County's plan to maintain the federal 8-hour ozone standard and attain the state 1-hour ozone standard, August 2007.

Table 3-3. VAFB annual emissions (tons) in 2006.

	CO	NO_x	PM_{10}	SO_x	ROC
Mobile					
On-Road	402.75	160.71	2.08	NE	46.06
Off-Road	575.78	20.02	2.34	0.91	20.60
Aircraft/Launch Vehicles	97.45	14.69	6.87	1.60	37.19
Permitted Sources	NE	1.35	0.48	0.42	3.30
Exempt Source	NE	19.63	NE	NE	32.96
Total	**1,075.98**	**216.40**	**11.77**	**2.93**	**140.11**

NE = Not estimated
SOURCE: VAFB, 30 CES/CEV, unpublished data

On January 24, 2007, President Bush issued EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*. One of the main goals established under this EO is the reduction of greenhouse gases through a reduction in energy intensity of 3 percent per year or 30 percent by the end of fiscal year 2015.

3.2 Biological Resources

Federal agencies are required by Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), to assess the effect of any project on federally listed threatened and endangered species. Under Section 7, consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries Service) is required for federal projects if such actions could directly or indirectly affect listed species (threatened, endangered, rare, or candidate) or destroy or adversely modify critical habitat. It is also Air Force policy to consider listed and special status species recognized by state agencies when evaluating impacts of a project.

Biological resources on VAFB are abundant and diverse because the Base is within an ecological transition zone, where the northern and southern ranges of many species overlap, and because the majority of the land within its boundaries has remained undeveloped. Fourteen major vegetation types have been described and mapped on VAFB (VAFB *In Progress*), which provide habitat for many federal and state listed threatened, endangered, and special concern plant and animal species.

3.2.1 Methodology

A literature search, general biological survey, and special status species survey were used to characterize the biological resources within the proposed project area. The scope of the biological surveys included vegetation and wildlife resources, as well as waters of the U.S. and wetlands. Field surveys and habitat assessments were completed from February through April 2008. Dominant and special status plant species, and vegetation types were identified and documented. Sight, sound, tracks, or other signs, determined presence of common and special status wildlife species.

Potential occurrence of plant and wildlife species, including special status species, was determined based on suitability of habitat and known occurrence, based on literature searches and other existing documentation. Sources used to determine potential occurrence include literature and maps of natural resources present at VAFB, California Natural Diversity Database (California Department of Fish and Game [CDFG] 1999,

2001, 2008a, 2008b); and existing local and regional references (Christopher 1996, 2002; Coulombe and Mahrdt 1976; Holmgren and Collins 1999; Keil and Holland 1998; Lehman 1994). Existing special status species surveys and location maps (SRS Technologies, Inc. [SRS] 2006, 2007; MSRS et al. 2008) were superimposed over the project area, via Geographic Information System (GIS) layers, and intersecting occupied habitat was documented and/or reviewed.

Delineation of wetlands within the proposed project area was conducted from February to April 2008 (MSRS 2008). Wetlands were delineated in accordance with the USACE *Wetland Delineation Manual* (1987), which requires an area to meet specific criteria for each of three wetland parameters (vegetation, hydrology, and soils) to be considered a wetland. Transects, oriented in a north-south direction perpendicular to the creek channel, were established at approximately 300- to 400-foot intervals for the entire length of the project area. Exact placement of these transects was based on site conditions. Four supplemental transects were established in intervening areas where additional plots were needed to determine wetland boundaries. Representative plots were chosen along each transect within different vegetation types, growing conditions, and/or at wetland-upland interface areas. Vegetation, hydrology, and soils were characterized for each plot, and the results recorded on USACE Wetlands Delineation Forms. The locations of soil test pits were documented using Global Positioning System (GPS) units. Appendix D contains the *Assessment of the Wetland Habitats at the San Antonio Creek Restoration Site* (MSRS 2008).

Waters of the U.S. encompass the jurisdictional limits of the authority of the USACE and include streams and their tributaries that have defined bed and banks and/or that have an OHWM, which is a line on the shore established by the fluctuations of ordinary water flows, as well as adjacent jurisdictional wetlands (33 CFR 320-330). The limits of jurisdictional waters of the U.S. were determined based on the characteristics of the banks of San Antonio Creek.

3.2.2 Vegetation Types

Approximately 41.28 acres of large areas devoted to agricultural fields and incised creek banks devoid of vegetation are present within the project area. Ten distinct natural vegetation types were identified within the project area (Figure 3-1), occurring as a mosaic of small patches or narrow bands. Vegetation types are described in detail below. Where suitable, nomenclature follows Holland (1986). Plant species nomenclature follows Hickman (1993). A complete list of species observed during field surveys is provided in Appendix C. Table 3-4 provides acreages of each vegetation type within the proposed project area.

Non-native Grassland

Non-native grassland is common in areas subjected to prior disturbance, allowing weedy non-native species to invade and become dominant. Within the proposed project area poison hemlock (*Conium maculatum*), black mustard (*Brassica nigra*), heart-podded hoary cress (*Lepidium draba*), and non-native annual grasses dominate this vegetation type.

Table 3-4. Vegetation types found within the proposed restoration area on VAFB.

Vegetation Type	Acreage
Non-native Grassland	29.51
Central Coast Scrub	9.08
Mixed Central Coast Scrub/ Non-native Grassland	2.28
Native Grassland	0.06
Willow Riparian	12.01
Mixed Willow Riparian/ Central Coast Scrub	0.81
Freshwater Marsh	3.18
Non-native Woodland	0.09
Ruderal	2.86
Agricultural	40.92

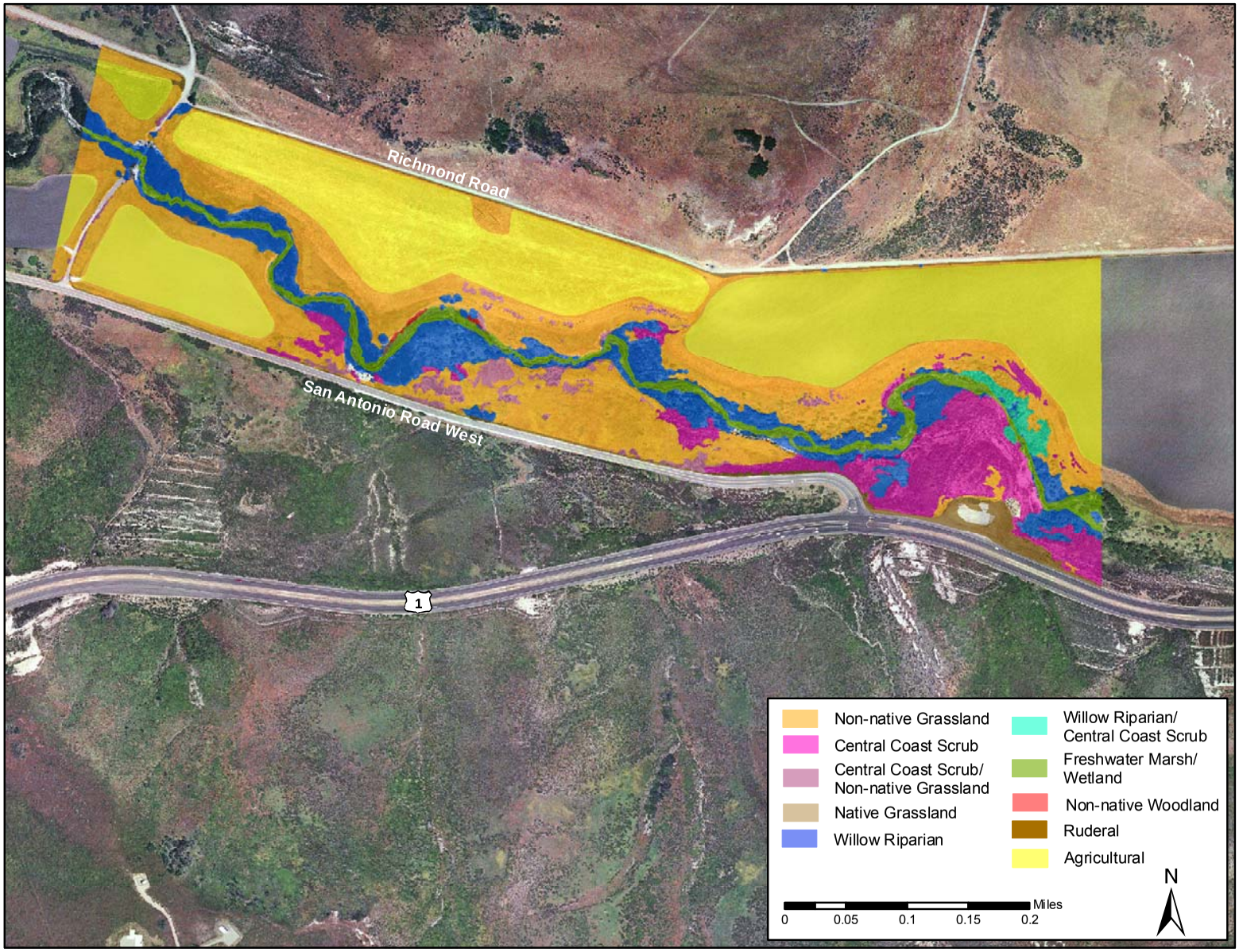

Figure 3-1. Vegetation types within the proposed project area.

Central Coast Scrub

Central coast scrub is a diverse community that occupies a narrow corridor extending along almost the entire coast of California. Shallow-rooted, mesophyllic plant species that are often drought-deciduous and summer-dormant characterize this community. Within the proposed project area, coyote brush dominates this vegetation type. California sagebrush (*Artemisia californica*), blue elderberry (*Sambucus mexicana*), and poison oak (*Toxicodendron diversilobum*) are also common components. Seacliff buckwheat (*Eriogonum parvifolium*), host plant of the federally endangered El Segundo blue butterfly (*Euphilotes battoides allyni*), is also present within this vegetation type. In most of the project area, annual non-native grassland species have invaded and now dominate the understory and openings in the shrub community.

Mixed Central Coast Scrub/ Non-native Grassland

Mixed Central Coast Scrub/Non-native Grassland is present where central coast scrub species have re-colonized areas of non-native grassland. Non-native grassland species such as heart-podded hoary cress dominate the intervening spaces and understory of the loosely clustered shrubs. Coyote brush is the dominant scrub species in these areas.

Native Grassland

Native grassland is extremely limited within the proposed project area, occurring in small patches totaling less than 0.1 acre. Native grasses and herbs such as giant wild rye (*Leymus condensatus*), and stinging nettle (*Urtica dioica*) dominate this vegetation type.

Willow Riparian

Willow riparian woodland is a dense, low, closed-canopy, broad-leafed, winter-deciduous, riparian forest dominated by red and arroyo willow (*Salix laevigata* and *S. lasiolepis*), which can grow as a tree or treelike shrub. A mature willow riparian community occupies the banks and slopes of San Antonio Creek within the project area. Native overstory species include mugwort (*Artemisia douglasiana*), marsh baccharis (*Baccharis douglasii*), poison oak, and California blackberry (*Rubus ursinus*). Understory species are sparse in many of the riparian areas. In areas where exotic species have invaded the understory, heart-podded hoary cress, poison hemlock, and black mustard dominate.

Mixed Willow Riparian/Central Coast Scrub

Loosely spaced willows with interspersed coyote brush characterize mixed willow riparian/central coast scrub. Other species such as blue elderberry, poison oak, and California blackberry are also common components.

Freshwater Marsh

Freshwater marsh occurs primarily as an understory within willow riparian communities subject to scouring during high creek flows. This vegetation type is present within and immediately adjacent to the creek channel, on low-lying terraces, and along ephemeral and secondary channels. Dominant plant species include cattails (*Typha* spp.) and rushes (*Scirpus* spp.). In the San Antonio Creek watershed west of Barka Slough to the Pacific Ocean, freshwater marsh habitat increased in percentage from 1928 to 1990 (The Nature Conservancy 1995). Scouring storm flows throughout January 2008, washed away most wetland vegetation within the proposed restoration area. At the time of field surveys in early February, this vegetation type was observed in an early successional state, dominated by seedlings or resprouts from buried root material.

Non-native Woodland

Non-native woodland, dominated by tree tobacco (*Nicotiana glauca*), grows on and at the base of steep, eroding slopes bordering the creek channel within the proposed project area.

Ruderal

Ruderal vegetation typically occurs at roadsides, waste areas, and other sites

continuously disturbed by activities such as traffic, road construction, and road maintenance. Annual and usually non-native forbs and grasses that can rapidly invade disturbed areas dominate ruderal vegetation types. Ruderal vegetation types border the existing roads within the project area. Both weedy non-native species adapted to frequent disturbance, such as sow thistle (*Sonchus oleraceus*), plantain (*Plantago erecta*), and annual grasses, as well as native species from adjacent habitats, such as coyote brush, California sagebrush, and vervain (*Verbena lasiostachys*), are present within this vegetation type. Gaviota tarplant (*Deinandra increscens* ssp. *vollosa*) , a federal and state endangered species, is common within the ruderal vegetation on VAFB.

Agricultural

Agricultural fields are sparsely vegetated due to regular intense disturbances such as mechanical disking. Due to an intense maintenance regime, perennial species are absent from these areas. Active agricultural areas are adjacent to San Antonio Creek within the proposed project area. Non-native annual grasses and forbs constitute the majority of vegetation present in these areas.

3.2.3 Wildlife Species

The diversity of fauna within and in the vicinity of the proposed project area may be attributed to the variety of habitat types along and adjacent to San Antonio Creek. Willow riparian woodland supports a wide variety of birds, due to the cover, foraging habitat, breeding and nesting habitat, and perch sites provided by the willow woodland (USACE 1998). In addition, a number of fish, reptile, amphibian, and mammal species use the upland and riparian habitats associated with San Antonio Creek for residence and migration corridors.

Wildlife species documented within the proposed project area are listed in Appendix C. This list also includes wildlife species not encountered during the surveys, but potentially present based on prior records in the vicinity. Surveys of invertebrate species were not done.

More birds are found in riparian woodlands than in any other habitat type on VAFB. Forty-six species of birds have been observed in this habitat (VAFB *In Progress*). The most abundant species was house finch (*Carpodacus mexicanus*). Year-round inhabitants include Bewick's wren (*Thryomanes bewickii*), spotted towhee (*Pipilo maculatus*), and downy woodpecker (*Picoides pubescens*). The willows in the project area also provide valuable habitat for birds migrating through the area.

California red-legged frog, Pacific treefrog (*Pseudacris regilla*) and ensatina (*Ensatina eschscholtzii*), are common amphibian species found in riparian areas at VAFB. The California red-legged frog is federally listed as threatened.

Fish species known to occur within San Antonio Creek include tidewater goby (*Eucyclogobius newberryi*), mosquito fish (*Gambusia affinis*), arroyo chub (*Gila orcutti*), unarmored threespine stickleback, and prickly sculpin (*Cottus asper*) (Swift et al. 1997). The tidewater goby and unarmored threespine stickleback are federally endangered species.

Reptile species observed in riparian areas on VAFB include western fence lizard (*Sceloporus occidentalis*), southern alligator lizard (*Elgaria multicarinata*), side-blotched lizard (*Uta stansburiana*), and western skink (*Eumeces skiltonianus*).

Large- and medium- sized mammal species commonly found in willow riparian forests include Virginia opossum (*Didelphis virginiana*), desert cottontail (*Sylvilagus audubonii*), brush rabbit (*Sylvilagus bachmani*), long-tailed weasel (*Mustela frenata*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and bobcat (*Felis rufus*). Small mammals include various species of mice (*Peromyscus* spp.), dusky-footed woodrat (*Neotoma fuscipes*), and Trowbridge's shrew (*Sorex trowbridgii*).

3.2.4 Special Status Species

Table 3-5 lists federal and state threatened and endangered species and other special status species that occur or have the potential to occur within the project area and its vicinity. The following are brief species accounts of these species.

Several species were excluded from potential occurrence because they either do not occur at the site during the time project activities would occur, they do not breed within the project area and their special status affords them protection only during their breeding period, or they do not occur in the form that affords them special status protection (i.e., rookeries or nesting colonies). These species and their current status are listed in Appendix C.

Unarmored Threespine Stickleback

The federally endangered unarmored threespine stickleback is a small, scaleless, freshwater fish that inhabits slow and quiet waters of streams and rivers. Historically, this species was found throughout southern California. By 1985, it only remained in a small portion of the upper Santa Clara River drainage and tributaries, in the lower 8.4 mi of the San Antonio Creek drainage and in Cañada Honda Creek (USFWS 1985).

Sticklebacks require slow water flow with low turbidity and aquatic vegetation for cover and

Table 3-5. Special status plant and wildlife species within the proposed project area.

Scientific Name **Common Name**	**Status**		**Occurrence**	**Habitat**	**Comments**
	USFWS[1]	**CDFG[2]**			
Plants					
Deinandra increscens ssp. *villosa* Gaviota tarplant	FE	SE	Potential	Grassland, ruderal	Blooms June – September
Fish					
Gasterosteus aculeatus williamsoni Unarmored threespine stickleback	FE		Documented	Perennial streams	Breeds year-round - peak in March
Amphibians					
Rana aurora draytonii California red-legged frog	FT	CSC	Documented	Perennial ponds, streams	Breeds February – April
Invertebrates					
Euphilotes battoides allyni El Segundo blue butterfly	FE		Potential	Coastal sand dunes	Adult flight period June – September
Birds					
Agelaius tricolor Tricolored blackbird	BCC	CSC	Documented	Dense tule stands, fields, pastures	Breeds March – July
Lanius ludovicianus Loggerhead shrike	BCC	CSC	Documented	Forage over all open habitats, breeds in shrubs or trees	Breeds March - August
Reptiles					
Actinemys marmorata Western pond turtle		CSC	Documented	Perennial lakes, ponds, streams. Eggs laid in upland areas,	Hatchlings overwinter in nest; move to aquatic sites March-April.

NOTES:
1 FE = Federal Endangered Species FT = Federal Threatened Species BCC = Federal Bird of Conservation Concern
2 SE = California Endangered Species CSC = California Species of Concern

nest material. While adults can occupy all areas of a stream, they tend to gather in areas of slow moving or standing water. Population size estimates (Baskin and Bell 1976) indicate that the best habitat for sticklebacks is small clean ponds in a stream with a constant flow of water. Sticklebacks are sensitive to excessive sedimentation and the loss of habitat through changes in water flow, water level, and the growth of emergent plants.

Breeding activity of sticklebacks peaks in March; however, it continues at a lower level throughout summer and fall. Unarmored threespine sticklebacks make their nests where ample vegetation and a gentle flow of water are present. The number of suitable nesting sites may be a limiting factor for this species. Young sticklebacks tend to be found at the shallow edges of streams in areas of dense vegetation.

On VAFB unarmored threespine sticklebacks are native to San Antonio Creek and were introduced into Cañada Honda Creek in 1984 (USFWS 1985). No individuals have been documented in Cañada Honda Creek in the last 10 years, and population estimates for the San Antonio Creek population are currently unavailable.

Sticklebacks are the most common fish species observed in San Antonio Creek (Swift et al. 1997) and are expected to be present anywhere within the project area. Swift (1999) reported unarmored threespine stickleback in high densities in the low-gradient portions of San Antonio Creek, where creek flows are slow and the channel is wide, with the highest abundance occurring within 1.25 mi of El Rancho Road.

California Red-legged Frog

This highly aquatic federally threatened amphibian inhabits quiet pools of streams, marshes, and occasionally ponds, where it prefers shorelines with extensive vegetation. It is active year-round in coastal areas, and can be found in upland areas during the winter and early spring. California red-legged frogs may breed as early as November, usually laying egg masses during or shortly following large rainfall events from late December to early April. Surveys conducted from 1995-2002 indicate California red-legged frogs begin breeding on VAFB in early January (Christopher 2002).

Critical habitat for the California red-legged frog was designated on March 13, 2001. VAFB was excluded from critical habitat designation under section 4(b)(2) of the federal ESA. As a result, the proposed project is not in critical habitat.

California red-legged frogs occur in nearly all permanent streams and ponds on VAFB (Christopher 1996). This species has been observed at every location surveyed along San Antonio Creek except near Hwy 1, where the water is too shallow (Christopher 1996). During the wetlands habitat assessment completed in February through April 2008, California red-legged frogs were regularly observed throughout the proposed creek restoration area. In August and September, the majority of California red-legged frog tadpoles would be expected to have metamorphosed. However, California-red-legged frog adults and tadpoles may occur anywhere along the creek during construction activities. Both juveniles and adults would be expected to use the project area as a travel corridor and may occur in any vegetation type within the project area where cover is present. Riparian vegetation immediately adjacent to the creek could be used as refuge for over-wintering tadpoles.

El Segundo Blue Butterfly

The federally endangered El Segundo blue butterfly occurs in coastal dune scrub, along coastal bluffs and in central coastal scrub. The adult flight period (June-September) coincides with the blooming period of its host plant, seacliff buckwheat (Arnold 1978, 1983; Pratt and Ballmer 1993). Eggs are deposited on buckwheat flowers and buds where the larvae feed until maturation. Upon maturation larvae burrow into the soil and pupate, usually within the root and debris zone of the host plant (Mattoni 1992; Pratt and Ballmer, pers. obs.). Pupae remain in diapause until at least

the following flight season. The number of adult butterflies that emerge in a given year is dependent on environmental conditions. The majority of the pupae may remain in diapause if environmental conditions are not favorable (Pratt and Ballmer 1993).

The occurrence of El Segundo blue butterfly at VAFB represents a significant extension of the butterfly's geographic range. It was originally thought to be restricted to remnant habitat patches from Playa del Rey to the Palos Verdes Peninsula in Los Angeles County, California (Arnold 1978, 1981).

Surveys within the proposed project area occurred outside the flight period for this butterfly; the project area has not been surveyed during the adult flight period. Approximately 350 seacliff buckwheat plants occur adjacent to a previously disturbed construction staging area within the proposed restoration area. The presence of seacliff buckwheat within and adjacent to the project area is indicative of the potential for El Segundo blue butterfly to also occur within this area. The project area is approximately 5.4 mi from the nearest documented occurrence of El Segundo blue butterfly (MSRS et al. 2008).

Gaviota Tarplant

A member of the Aster family, the federally endangered Gaviota tarplant is a gray-green, hairy, summer flowering annual with stems branching near the base. This plant is most often associated with grasses, and on occasion, with coastal shrubs such as *Baccharis* and *Isocoma*. Gaviota tarplant is endemic to Santa Barbara County and there are several locations of this species on VAFB. While most locations are coastal, some extend inland.

The USFWS designated critical habitat for Gaviota tarplant on November 7, 2002. VAFB was excluded from this designation under section 4(b)(2) of the federal ESA. As a result, the proposed project is not in critical habitat.

In excess of 100 tarplant (*Deinandra increscens*) seedlings were documented within the proposed project area. The February 2008 surveys were outside the plant's flowering period (May-September) when the federally endangered subspecies *villosa* is definitively identifiable. However, in areas surveyed adjacent to the proposed project area in the past, tarplant was found to be consistent with the common subspecies *increscens* (SRS 2007).

Tricolored Blackbird

Within California, this federal bird of conservation concern occurs in the Central Valley as well as along the central and southern coasts. Colonies require nearby water, a suitable nesting substrate, and open-range foraging habitat of natural grassland, woodland, or agricultural cropland. In the non-breeding months, tricolored blackbirds often roost at night in large flocks in wetlands, but during the day they commute to feeding areas. During the breeding season (March-July), tricolored blackbirds nest in tules, cattails, and willows, in or adjacent to freshwater or brackish wetlands. This species has been observed near San Antonio Creek, although there are no records of breeding (Holmgren and Collins 1999).

Loggerhead Shrike

This federal bird of conservation concern is a common resident and winter visitor in lowlands and foothills throughout California, preferring open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches. During the breeding period (March-August), it builds nests on stable branches of densely foliaged shrubs or trees. Shrikes are regularly observed foraging throughout open areas adjacent to San Antonio Creek (Holmgren and Collins 1999, The Nature Conservancy 1995). The coastal scrub within and adjacent to the project site offers potential breeding habitat for this species.

Western Pond Turtle

This California species of concern inhabits rivers, streams, ponds, and other seasonal and perennial wetlands that have refugia and pools up to 1 meter (m) deep (Holland 1986).

Western pond turtles occur from the foothills of the Sierra Nevada to coastal and southern California. The breeding period for this species is April through August.

Western pond turtles were recorded within the proposed restoration area and downstream along San Antonio Creek and adjacent pools during surveys conducted in 1996 (Christopher), and during biological surveys conducted for the proposed creek restoration project in 2008. The riparian habitat within San Antonio Creek provides suitable breeding habitat for this species.

3.2.5 Other Species Considered

Other special status species considered include the federally endangered tidewater goby, southern steelhead (*Oncorhynchus mykiss*), Gambel's watercress (*Nasturtium gambellii*), and southwestern willow flycatcher (*Empidonax traillii extimus*). These species have not been documented within the project area; therefore, they were excluded from further discussion.

3.2.6 Waters of the United States and Wetlands

San Antonio Creek is actively adjusting its profile and channel geometry between Barka Slough and Lompoc-Casmalia Road, and has experienced significant erosion (degradation), deposition (aggradation), channel widening, and bend migration in recent years. The creek bed was substantially higher in elevation historically. Based on a comparison of topographic map data from 1993 and 2005, approximately 6 to 9 ft of degradation (channel lowering) has occurred within the proposed restoration area during this 12-year period (HDR 2008). The present alignment and location of the creek is the result of downcutting, scour and soil deposition that have restricted the flow. Because rainfall during the 2007-2008 season was average, the extent of the 2008 high flow was used to determine the OHWM.

For the wetland hydrology criterion to be met a site must be inundated or saturated or exhibit features that show the area was inundated or saturated for the required period of time (i.e., 45 days). A wetlands habitat assessment was completed within the project area from February through April 2008 (MSRS 2008). A report summarizing the results of this assessment is included in Appendix D. During this assessment, drift lines and drainage patterns in wetlands were the most common and extensive primary indicators of wetland hydrology within the project area. Along the main channel of San Antonio Creek, where steep banks are present, pronounced terracing is also apparent, indicative of creek flow. In areas where rock riprap or vertical banks devoid of vegetation are present, water staining is the primary indicator of wetland hydrology. Saturation in the upper 12 inches was restricted to areas immediately adjacent to the main channel of San Antonio Creek, ephemeral feeder channels, and hillside seeps.

Areas that currently meet the criteria for wetlands include areas encompassed within the OHWM of San Antonio Creek, wetlands adjacent to the channel, and areas bound by the channel. A total of 3.18 acres of wetlands were identified within the creek restoration area. Waters of the U.S. encompass wetlands as well as areas of open water and areas bound by the OHWM. A total of 4.75 acres within the project area constitute Waters of the U.S. and are subject to the jurisdiction of the USACE under Section 404 of the Clean Water Act (CWA).

3.3 Cultural Resources

Section 106 of the of the National Historic Preservation Act (NHPA) requires federal agencies to assess potential project related effects to historic properties that are listed or eligible for listing in the National Register of Historic Places (NRHP). Associated implementing regulations include 36 CFR 800. A synopsis of the prehistory and ethnohistory of the region is included in Appendix E.

3.3.1 Cultural Resource Studies

An archaeological record search was completed at the California Historical Resources Information System Central Coast Information Center, University of California, Santa Barbara (UCSB), and the 30th Civil Engineer Squadron, Environmental Flight (30 CES/CEV) Cultural Resources Section at VAFB. Background research included a review of archaeological literature, archaeological base maps, and cultural resources records. Information was collected from previous inventories and archaeological studies within 1 mi, and known sites within 0.25 mi, of the project area. Maps consulted at the 30 CES/CEV Cultural Resources Section include the VAFB C-1 series (46 map set), Base Comprehensive Plan GIS, and U.S. Geological Survey (USGS) topographic maps. Aerial photographs at the UCSB Map and Imagery Library were also consulted.

Record search results indicate that 42 surveys or other cultural research studies have been conducted within 1 mi of the proposed project area (Table 3-6). Eleven of those studies are within or adjacent to the project area.

The earliest documented archaeological study in the project area was a large-scale inventory covering much of VAFB during the late 1960s and early 1970s (Spanne 1974). That survey encompassed several sections of San Antonio Creek, but was significantly hampered by dense vegetation along the creek. Four archaeological sites within 0.25 mi of the proposed project area (CA-SBA-1009, -1011, -1012, and -1013) were identified during this survey. Two of these sites (CA-SBA-1009 and -1011) are within or near the proposed project area.

Greenwood and Foster (1981) report archaeological investigations in the San Antonio Creek valley in conjunction with the Range Improvement Project. These investigations included a survey of 4.75 mi of fence line, as well as testing to evaluate significance and to assess potential adverse project effects at various sites along the creek channel. No new sites were identified within the proposed project area, although their effort included minimal subsurface probing at two previously recorded sites (CA-SBA-1009 and -1011) within or near the project area.

Berry (1991) completed a survey for an overhead power line that crosses San Antonio Creek in the vicinity of the lower project area. Although numerous previously recorded sites were recognized within or near the power line corridor, no new sites were discovered adjacent to the creek.

In the mid-1990s, a basewide archaeological survey was completed that included the proposed project area (Carbone and Mason 1998). That effort identified no new archaeological resources within the current project area.

The Mission Hills and Santa Ynez Extensions of the Coastal Branch Aqueduct crossed the San Antonio Creek valley just west of the lower end of the proposed project area. A preconstruction survey of the aqueduct corridor did not identify archaeological resources in the valley bottom (Science Applications International Corporation [SAIC] 1994). However, in September 1994 construction of the aqueduct revealed a buried site (CA-SBA-2696) in the valley bottom. Subsequent testing revealed that CA-SBA-2696 is a stratified, multi-component site, encompassing approximately 78,000 square meters buried beneath alluvium (Price et al. 2006). The site was determined eligible for the NRHP in 1995 and data recovery excavations to mitigate the adverse effects of aqueduct construction were completed in 1996 (Colten et al. 1997).

Given the discovery of a significant buried site (CA-SBA-2696) in the San Antonio Creek valley (Colten et al. 1997; Price et al. 2006) during construction of the Coastal Branch Aqueduct, VAFB requested a survey of the cutbanks along San Antonio Creek as part of an archaeological study for the El Rancho Road Bridge Project (Lebow 2000). The survey encompassed both sides of the creek between the upper end of Barka Slough and Lompoc-Casmalia Road, including the proposed project area. Erosional cutbanks

Table 3-6. Previous cultural resource studies within one mile of the proposed project area.

References (in chronological order)	VAFB Reference Number	UCSB Reference Number
Spanne (1973)	VAFB-1973-01	
Spanne (1974)*	VAFB-1974-02	
WESTEC Services Inc. (1981)	VAFB-1981-04	V-16
Greenwood and Foster (1981)*	VAFB-1981-09	V-7
WESTEC Services Inc. (1982)	VAFB-1982-02	V-42
WESTEC Services Inc. (1983)	VAFB-1983-02	V-19
Rudolph (1983)	—	V-31
Greenwood (1984)	VAFB-1984-18	
Foster and Greenwood (1985)	VAFB-1985-12	
Stone (1985)	VAFB-1985-16	
Foster (1985)	VAFB-1985-19	V-23
Woodman et al. (1985)	VAFB-1985-23	
Thorne and Waldron (1985)	VAFB-1985-29	
Bowser and Morgan (1986)	VAFB-1986-03	
Stone (1986a)	VAFB-1986-04	
Stone (1986b)	VAFB-1986-18	
Gibson (1987a)	VAFB-1987-03	V-134
Gibson (1987b)	VAFB-1987-08	
Rudolph (1988)	VAFB-1988-08	V-201
Woodman and McDowell (1989)	VAFB-1989-08	V-208
Kirkish (1990)	VAFB-1990-12	
Berry (1991)*	VAFB-1991-03	V-131
Thorne (1993)	VAFB-1993-02	
Berry (1994)	VAFB-1994-01	
Science Applications International Corporation (1994)*	VAFB-1994-16	
Wilcoxon and Haley (1996)	—	V-165
Haslouer and Kay (1996)	VAFB-1996-09	
Woodman (1997)	—	V-163
Clark (1997)	VAFB-1997-01	V-159
Harro and Ryan (1997)	VAFB-1997-09	V-175
Colten et al. (1997)*	VAFB-1997-21	V-198a
Carbone and Mason (1998)*	VAFB-1998-03	V-258
Lebow (2000)*	VAFB-2000-17	V-285
Lebow and McKim (2001)	VAFB-2001-05	V-307
Harro and Lebow (2002)	—	V-308
Parreira (2003)*	M-2003-02	V-310
Mirro and Lebow (2003)*	VAFB-2003-02	
Davis (2003)	VAFB-2003-06	
Parreira (2004)	—	V-336
RESCOM Environmental Group Corp (2004)	—	V-371
Lebow et al. (2005)	—	V-367
Price et al. (2006)*	—	

*Within the proposed restoration area.

were examined to identify buried archaeological sites and isolated artifacts. That effort identified five previously unknown sites, all buried under non-cultural sediments. One of these sites, CA-SBA-3607, is within or adjacent to the proposed project area.

Applied EarthWorks, Inc. completed an archaeological survey after the Harris wildfire to take advantage of the increased surface visibility following the burn (Mirro and Lebow 2003). Only the northern bank of San Antonio Creek had burned in the vicinity of the proposed project area, so the only portion of the current project area surveyed was the northern bank at the eastern end of the project area. No new archaeological resources were identified.

In 2003, a new drainage system was installed along the eastern end of San Antonio Road West. Part of this effort included a concrete-lined ditch paralleling the southern edge of the road. This ditch terminated at a culvert that was buried under the road and emptied into San Antonio Creek at Bank Stabilization Site 2. An Applied EarthWorks, Inc. archaeologist and Native American representative (Parreira 2003) monitored excavations for the ditch and culvert. No archaeological resources were identified.

In 2004, a second survey of the San Antonio Creek cutbanks was completed to determine whether additional archaeological resources were exposed due to ongoing erosion. Again, this survey encompassed the proposed project area. No new archaeological resources were identified; however, previously recorded sites were examined more closely, cutbank exposures were profiled and, where possible, radiocarbon samples were collected. Analysis of 17 samples from buried sites revealed human occupations ranging between Anno Domini (A.D.) 120 and 5600 Before Christ (B.C.).

In support of the proposed creek restoration, VAFB conducted an Extended Phase -1 Archaeological Survey to identify buried archaeological deposits within the proposed project area in 2008. A series of 50-centimeter-diameter (1.6 ft) shovel test pits were excavated to identify archaeological remains between the ground surface and 1 m (3.3 ft) below ground surface. To identify archaeological remains below 1 m (3.3 ft), non-traditional archaeological excavation methods were employed. A truck-mounted drilling rig drilled 23 10-centimeter-diameter (3.5-inch) continuous soil cores to depths ranging from 10 to 15 m (34 to 49 ft) below ground surface.

3.3.2 Recorded Cultural Resources

Nine previously recorded archaeological sites and one isolated artifact are recorded within 0.25 mi of the proposed project area. Of these, five cultural resources are within or immediately adjacent to the creek restoration area (Table 3-7).

In addition, three previously unknown subsurface archaeological deposits were identified during surveys conducted for the proposed project (Table 3-7). These deposits are located at least 0.43 m (1.4 ft) below ground surface. An archaeological site record is currently being prepared for this site. Upon completion, the site record will be sent to the California Historical Resources Information System at UCSB, so that a Primary Number and Trinomial can be assigned to the site.

Table 3-7. Previously recorded resources within and adjacent to the archaeological study areas.

Resource	NRHP Status
CA-SBA-1009	Unevaluated
CA-SBA-1011	Unevaluated
CA-SBA-2696	Eligible
CA-SBA-3606	Unevaluated
CA-SBA-3607	Unevaluated
CA-SBA-3932*	Unevaluated
CA-SBA-3933*	Unevaluated
CA-SBA-3934*	Unevaluated

*Previously unknown

For purposes of this project only, the seven unevaluated resources are assumed eligible for the NRHP. Cultural resources within and adjacent to the proposed project area are described below.

CA-SBA-1009

CA-SBA-1009 was originally recorded in 1972 as a low-density scatter of marine shell and flaked stone artifacts visible in the vertical banks of San Antonio Creek (Spanne 1974). Subsequently, two shovel test pits excavated within site boundaries recovered only two pieces of marine shell at 20 centimeters (cm) (8 inches) below the surface (Greenwood and Foster 1981). No artifacts were observed on the ground surface at that time. During a survey of the San Antonio Creek banks in 2000, the surface deposit was found to be much as described in the 1972 site record (Lebow 2000). However, the cultural deposit exposed in the creek bank appeared to have a much higher density, suggesting the site is primarily buried and that cultural materials exposed on the surface have moved upward through post-depositional processes. Radiocarbon analysis of two samples collected during a survey in 2004 indicates the site was occupied around A.D. 390–450 (Lebow et al. 2007).

CA-SBA-1011

CA-SBA-1011 was originally recorded in 1972 as a low-density scatter of marine shell and flaked stone artifacts. Excavation of two shovel probes yielded only two pieces of marine shell (Greenwood and Foster 1981). During survey of the San Antonio Creek banks in 2000, two chert flakes and two marine shell fragments were observed on the sediment apron below the vertical bank (Lebow 2000). These items were slightly upstream from the site's recorded boundary, so the boundary was extended to the east to include these materials. No in situ cultural materials were observed in the creek bank. Radiocarbon analysis of three samples collected during a survey in 2004 indicates the site was occupied between about A.D. 120 and 360 (Lebow et al. 2007). No cultural materials were observed at the site during the survey for the proposed project.

CA-SBA-2696

CA-SBA-2696 was originally recorded in 1994 during construction of the Coastal Branch Aqueduct (Price et al. 2006). Test excavations found the site was significant, and it was determined eligible for the NRHP in May 1995. Subsequent data recovery excavations focused on the aqueduct construction corridor (Colten et al. 1997). The uppermost 70 cm (2.3 ft) of soil is non-cultural alluvium. From 70 to 210 cm (2.3 to 6.9 ft) below surface, CA-SBA-2696 contains three distinct archaeological deposits in separate strata. Radiocarbon analysis revealed an initial occupation between 370 B.C. and A.D. 45, followed by a brief hiatus, and a second occupation between A.D. 105 and 340. The site was then abandoned, reoccupied, and abandoned for the last time around A.D. 590. The initial occupation was most intensive and occupants appear to have focused on hunting and processing large mammals. The subsequent occupation was less intensive and occupants focused more on hunting lagomorphs and less on large mammals. The final occupation was the least intensive, and occupants hunted both small and large mammals (Colten et al. 1997).

CA-SBA-3606

CA-SBA-3606 was originally recorded in 2000 along the northern bank of San Antonio Creek for approximately 70 m (230 ft) (Lebow 2000). Site contents include approximately 20 flakes, one projectile point fragment, 10 fire-altered rocks, three marine shell fragments, and one large-mammal long bone. Only a single marine shell fragment was observed in the creek cutbank in the upper 50 cm (20 ft), suggesting that the archaeological deposit is primarily on or near the surface (Lebow 2000). However, during a survey of the creek bank in 2004, archaeological remains were observed to a depth of 270 cm (9 ft) below ground surface (Lebow et al. 2007). Radiocarbon analysis of four marine shell fragments returned age determinations between 5600 and 3710 B.C.

CA-SBA-3607

CA-SBA-3607 was originally recorded during a survey of the San Antonio Creek banks in 2000 (Lebow 2000). It extends for approximately 70 m (230 ft) along the creek and was visible only in the southern bank of the creek bank approximately 2 m (6.6 ft) below the ground surface. Artifacts observed include three flakes, a large-mammal long bone fragment, and a large-mammal mandible fragment. No cultural materials were observed at this site during the 2004 survey (Lebow et al. 2007).

CA-SBA-3932

CA-SBA-3932 was identified during the Extended Phase-1 Archaeological Survey. Seven 10-centimeter-diameter (3.5-inch) auger holes encountered flakes, terrestrial mammal bone, fish bone, and shell remains from 2.1 to 5.5 m (6.9 to 18.0 ft) below ground surface within the 8.5-m (28-foot) thick block of floodplain that would be excavated at Bank Stabilization Site 1.

CA-SBA-3933

CA-SBA-3933 was identified during the subsurface archaeological survey on the north bank of San Antonio Creek within the proposed restoration area. The deposit is a subsurface archaeological midden that extends from 3.08 to 3.47 m (10.1 to 11.4 ft) below ground surface. Site constituents included flakes, terrestrial mammal bone, fish bone, and shell remains in fairly high densities. This was the densest deposit encountered during the subsurface archaeological survey.

CA-SBA-3934

CA-SBA-3934 was identified during the subsurface archaeological survey on the south bank of San Antonio Creek within the proposed restoration area. The site is a subsurface deposit located from 0.43 to 0.73 m (1.4 to 2.4 ft), 4.82 to 4.97 m (15.8 to 16.3 ft), and 10.82 to 11 m (35.5 to 36.1 ft) below ground surface. Site constituents include flakes and shell remains.

3.4 Earth Resources

3.4.1 Geology and Soils

VAFB is a geologically complex area that includes the transition zone between the Southern Coast Range and Western Transverse Range geomorphic provinces of California. The geologic features of VAFB have been an important factor in the development of the diverse natural habitats found in this primarily undeveloped stretch of California coastline. VAFB is underlain predominantly by marine sedimentary rocks of Late Mesozoic age (140 to 70 million years before the present) and Cenozoic age (70 million years to the present). The basal unit underlying the entire base is the Franciscan Formation of upper Jurassic age (Dibblee 1950). The Franciscan Formation consists of a series of sedimentary and volcanic rocks with numerous serpentine intrusions. Extensive folding and faulting throughout the VAFB area has created four structural regions: the Santa Ynez range, the Lompoc lowland, the Los Alamos syncline, and the San Rafael Mountain uplift (Reynolds et al. 1985). The Santa Ynez range consists of a very thick Cretaceous-Tertiary sedimentary section uplifted along the Santa Ynez fault; it was then subsequently folded. The Lompoc lowland is an area of low relief that is structurally synclinal but has Franciscan basement relatively close to the surface. The Los Alamos syncline is a deep structural down warp traversing the Los Alamos and upper Santa Ynez valleys. Faulting along the southwestern margin of the mountain range uplifted the San Rafael Mountains. The majority of the folds in these structural regions are oriented to the northwest.

The two major riparian environments in the east/west trending valleys of VAFB are San Antonio Creek and the Santa Ynez River. The proposed project area is located within the San Antonio Valley along the north side of the Purisima Hills. The San Antonio Valley lies within the Santa Maria Basin-San Luis Range domain of central California, a

geologic transition zone between the Transverse Ranges Geomorphic Province to the south and the Coastal Ranges Geomorphic Province to the north. The region between these ranges is a structural depression, with Tertiary age rocks forming a series of broad folds (synclines and anticlines) with westward trending axes (Worts 1951).

A Sorrento-Mocho-Camarillo soil association, as are all river and creek areas on VAFB, characterizes the San Antonio Creek area. This soil type is found in nearly level to moderately sloping terrain such as floodplains and alluvial fans. This is a well drained to somewhat poorly drained soil, ranging from sandy loams to silty clay loams (Shipman 1981). It is composed of 40 percent Sorrento soils, 30 percent Mocho soils, 10 percent Camarillo soils, and 20 percent other soil series. The Sorrento series consists of well-drained sandy loams to clay loams, which are recent fluvial or alluvial deposits, and have a high to very high fertility. The erosion hazard is none to slight for Sorrento sandy loams and slight to moderate for Sorrento loams. The Sorrento series has a low to moderate shrink-swell potential. The Mocho series consists of well-drained alluvial and silty loams with a moderate to high fertility. It has a low to moderate shrink-swell potential and its erosion factor is none to slight. The Camarillo series consists of poorly drained, very fine-grained sandy loams to silty clay loams, which are alluvial in origin and have eroded from sandstone and shale bedrock. The fertility for the Camarillo series is moderate to high, there is no erosion hazard, and it has a low to moderate shrink-swell potential (Shipman 1972).

Subsurface conditions within the proposed project area generally consist of a variable thickness of existing fill, and alluvium overlying Sisquoc Formation and landslide deposits (Fugro 2006). The Sisquoc Formation typically consists of thickly bedded shale, siltstone and claystone, and weathers to a dark, clay rich soil at the ground surface that can be expansive and prone to landsliding. The alluvium and landslide deposits consist of interbedded sand and clay. Weaker artificial fill and alluvium materials are prone to erosion.

Dibblee (1989) maps relatively large landslides along the north facing hillsides south of Hwy 1. A geotechnical study (Fugro 2006) conducted within the proposed project area reports some of the landslides may be larger than shown by Dibblee, and indicates the presence of active debris flows, surficial instability, and smaller landslides along the flanks of some of the larger landslides, particularly in the area upslope of Site 1 (Figure 2-1). If movement of the landslides or debris flows occurs in response to erosion, earthquakes or weather conditions, there is potential for the movement to impact the project area, Hwy 1, San Antonio Road West, and San Antonio Creek.

3.4.2 Seismology

The Santa Barbara County region is seismically active with a major earthquake occurring in the region about every 15 to 20 years (USAF 1987, Alterman et al 1994). The Santa Ynez-Pacifico Fault Zone, the Lompoc-Solvang (Santa Ynez River)-Honda Fault Zone, the Lions Head-Los Alamos-Baseline Fault Zones, and their potential offshore extensions, are three of the primary fault zones that project through VAFB (Alterman et al 1994).

These fault systems within the Transverse Ranges are considered active (Jennings 1994) and capable of generating damaging earthquakes. Moderate or major earthquakes along these systems could generate strong or intense ground motions in the area, and possibly result in surface ruptures of unmapped faults along the northern and southern boundaries, as well as the central part of VAFB.

3.4.3 Geological Hazards

The proposed project area within San Antonio Creek is located in a seismically active portion of Central California. Potential hazards that could affect the site and result in structural damage include faulting, ground shaking,

liquefaction, lateral spreading and flooding. The hazards consist of seismically induced settlement, and collapse (hydroconsolidation) potential.

The potential for surface fault rupture on VAFB is generally considered to be low (USAF 1987). At the present, there are no known areas where liquefaction has occurred. Areas most prone to liquefaction are those in which there is sandy to silty soil, the water table is within 50 ft of the surface, and earthquake loading exceeds 20 percent of gravity. The areas most prone to liquefaction on VAFB are near San Antonio Creek and the Santa Ynez River. The potential for liquefaction on VAFB, despite these areas, is still considered low (USAF 1987).

3.5 Hazardous Materials and Waste Management

Hazardous materials and wastes are those substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601-9675); the Toxic Substances Control Act (15 U.S.C. 2601-2671); the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA; 42 U.S.C. 6901-6992); and as defined in the State of California corresponding laws and regulations. In addition, federal and state Occupational Safety and Health Administration (OSHA) regulations govern protection of personnel in the workplace. In general, the definitions within the citations include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health and welfare, to workers, or the environment.

3.5.1 Hazardous Materials Management

VAFB uses approximately 5,000 hazardous materials items to accomplish its mission and mission support activities. The hazard potential of the materials used range across the spectrum of toxicity. Users of hazardous materials must also comply with California Business Plan requirements. Management of hazardous materials used on VAFB follows procedures found in 30 SWP 32-7086, *Hazardous Materials Management Plan*. The Base Hazardous Materials Pharmacy (HazMart) maintains inventories of hazardous materials, whether purchased by the Air Force or its contractors. Before releasing hazardous materials to the user, HazMart staff ensures a copy of the Material Safety Data Sheet is available and verifies that the material is suitable for use on VAFB. By providing handling and use information, VAFB controls the potential misuse of hazardous materials, maintains an accounting of the types of hazardous materials used on Base, and accomplishes usage and emissions reports as required by federal, state, and local environmental regulations. Hazardous materials used during project activities include petroleum, oil, and lubricants (POLs) in equipment and vehicles.

3.5.2 Hazardous Waste Management

Management of hazardous waste at VAFB complies with the RCRA Subtitle C (40 CFR Part 240-299) and with California Hazardous Waste Control Laws as administered by the California EPA, Department of Toxic Substances Control, under Title 22, Division 4.5 of the California Code of Regulations (CCR). These regulations require that hazardous wastes be handled, stored, transported, disposed of, or recycled according to defined procedures. The VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A, outlines the procedures to be followed for hazardous waste management.

Contractors generating hazardous wastes in support of a government contract are required to follow federal, state, and local laws and regulations, and use the Air Force Generator Identification Number to account for hazardous wastes generated. Because of the amount of hazardous waste generated per month under its Generator Identification

Number, VAFB is classified as a large quantity, fully regulated generator, required to comply with all laws regulating the generation, storage, transportation, and disposal of hazardous waste. VAFB employs a "cradle to grave" waste management approach. Hazardous waste is accumulated following rules applicable to either the larger quantity or small quantity generator status. Waste is transferred off-site in properly labeled Department of Transportation approved container from its point of origin to a permitted off-site treatment storage or disposal facility. The VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A, provides detailed procedures for hazardous waste accumulation and management. Construction/demolition contractors would use the VAFB Generator Identification Number, and would have to comply with the VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A. Hazardous waste is removed from VAFB under hazardous waste manifest and shipped off-site for final disposal.

3.5.3 Installation Restoration Program

The federal Installation Restoration Program (IRP) was implemented at Department of Defense facilities to identify, characterize, and restore hazardous substance release sites. There are currently 136 IRP sites throughout VAFB grouped into six Operable Units based on similarity of their characteristics.

IRP sites are remediated through the Federal Facilities Site Remediation Agreement, a working agreement between the USAF, the Central Coast Regional Water Quality Control Board (RWQCB), and the Department of Toxic Substances Control. In addition to IRP sites, there are identified Areas of Concern (AOCs), where potential hazardous material releases are suspected; and Areas of Interest (AOIs), defined as areas with the potential for use and/or presence of a hazardous substance. Various contaminants could be present at these sites including trichloroethylene, polychlorinated biphenyls, volatile organic compounds, total petroleum hydrocarbons, asbestos, and other hazardous contaminants. No IRP sites, AOCs or AOIs have been identified within the proposed creek restoration area.

3.6 Human Health and Safety

The affected environment for Human Health and Safety includes those areas within VAFB where safety constraints associated with past and present VAFB mission and operations are in effect. It also includes the regulatory environment for health and safety issues established to minimize or eliminate potential risk to the general public and personnel involved in the restoration project under the Proposed Action.

3.6.1 Public Safety

Heavy flows along San Antonio Creek in February 1998 caused severe damage in several areas along the channel course, threatening the integrity of San Antonio Road West at several locations. Commuters traveling between VAFB and the community of Casmalia use San Antonio Road West on a daily basis. It is also one of the primary routes providing access to facilities on north Base. Risks to public safety resulting from potential road failure at the affected sites along San Antonio Road West exist under current conditions.

3.6.2 Worker Safety

Relevant health and safety requirements include industrial hygiene and ground safety. Industrial hygiene is the responsibility of the 30 SW Safety Office (30 SW/SE) and the 30th Medical Operations Squadron, Bioenvironmental Engineering Element (30 MDOS/SGOAB), and contractor safety departments. Responsibilities include monitoring and exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations. Ground safety is the responsibility of 30 SW/SE and includes

protection from hazardous situations and hazardous materials. All construction activities and facility operations and maintenance on VAFB are subject to the requirements of the federal OSHA, and Air Force Occupational Safety and Health (AFOSH) regulations. Moreover, California OSHA has jurisdiction over non-federal operations south of Honda Ridge Road on south Base.

Hazardous materials, primarily POLs, would be used for operating equipment and vehicles, and for restoration activities under the Proposed Action. The potential exists for unexpected releases of these POLs, which would generate hazardous waste. Therefore, the potential exists for persons participating in project activities to become exposed to hazardous materials and hazardous waste. In addition, the following physical features have the potential to be present in the vicinity of project areas, and have the potential to adversely impact the health and safety of site workers:

- Physical hazards including traffic on the roads, holes and ditches, uneven terrain, sharp or protruding objects, slippery soils or mud, and unstable ground.
- Biological hazards such as animals (insects, spiders, and snakes), and disease vectors (ticks and rodents).

3.6.3 Noise

The Noise Control Act (NCA; 42 U.S.C. 4901 *et seq.*) sought to limit the exposure and disturbance that individuals and communities experience from noise. It focuses on surface transportation and construction sources, particularly near airport environments. The NCA also specifies that performance standards for transportation equipment be established with the assistance of the Department of Transportation. Section 7 of the NCA regulates sonic booms and gave the Federal Aviation Administration regulatory authority after consultation with the U.S. EPA. In addition, the 1987 Quiet Community amendment gave state and local authorities greater involvement in controlling noise.

Noise is often defined as unwanted sound that can interfere with normal activities or otherwise diminish the quality of the environment. Depending on the noise level, it has the potential to disrupt sleep, interfere with speech communication, or cause temporary or permanent changes in hearing sensitivity in humans and wildlife. Noise sources can be continuous (e.g., constant noise from traffic or air conditioning units) or transient (e.g., a jet overflight or an explosion) in nature. Noise sources also have a broad range of frequency content (pitch) and can be nondescript, such as noise from traffic or be specific and readily definable, such as a whistle or a horn. The way the acoustic environment is perceived by a receptor (animal or person) is dependent on the hearing capabilities of the receptor at the frequency of the noise, and their perception of the noise (URS Corporation 1986).

The amplitude of sound is described in a unit called the decibel (dB). Because the human ear covers a broad range of encountered sound pressures, decibels are measured on a quasi-logarithmic scale. The dB scale simplifies this range of sound pressures to a scale of 0 to 140 dB and allows the measurement of sound to be more easily understood.

There are many methods for quantifying noise, depending on the potential impacts in question and on the type of noise. One useful noise measurement in determining the effects of noise is the one-hour average sound level, abbreviated L_{eq1H}. The L_{eq1H} can be thought of in terms of *equivalent* sound; that is, if a L_{eq1H} is 45.3 dB, this is what would be measured if a sound measurement device were placed in a sound field of 45.3 dB for 1 hour. The L_{eq1H} is usually A-weighted unless specified otherwise. A-weighting is a standard filter used in acoustics that approximates human hearing and in some cases is the most appropriate weighting filter when investigating the impacts of noise on wildlife as well as humans. Examples of A-weighted noise levels for various common noise sources are shown in Table 3-8.

Another useful acoustical metric for describing sound events is the A-weighted sound exposure level (SEL). The A-weighted SEL is the total sound energy in a sound event *if that event could be compressed into one (1) second.* In essence, SEL is an average sound level that is condensed into 1 second. This provides a time-normalized metric and allows for analysis of events with different durations. As an example, an F-16 aircraft overflight (85 percent full power, altitude 210 ft, speed of 443 knots) was measured to have an A-weighted SEL of 113.1 dB (Berry et al. 1991).

The "peak sound level" is the greatest instantaneous sound level reached during a sound event. Peak levels also have various frequency weightings applied to them. Peak levels, though useful in some cases, can often be misleading. It can occur that a single peak in a complex waveform can be substantially greater than the majority of a sound event. Therefore, peak levels should always be presented along with one or more of the metrics described above to better describe the sound event. An unweighted peak sound level is simply the peak sound level with no frequency weighting applied.

Existing noise levels on VAFB are generally quite low due to the large areas of undeveloped landscape and relatively sparse noise sources. Background noise levels are primarily driven by wind noise; however, louder noise levels can be found near industrial facilities and transportation routes. Rocket launches and aircraft over flights create louder intermittent noise levels. On VAFB, general ambient L_{eq1H} measurements have been found to range from around 35 to 60 dB (Thorson et al. 2001). Most activities associated with the Proposed Action would generate relatively continuous noise. Noise levels of typical heavy construction equipment, as would be used under the Proposed Action are presented in Table 3-9.

Table 3-8. Comparative A-weighted sound levels.

Noise Level (dBA)	Common Noise Levels	
	Indoor	Outdoor
100 – 110	Rock band inside New York subway	Jet flyover at 304 meters
90 – 100	Food blender at one meter	Gas lawnmower at one meter
80 – 90	Garbage disposal at one meter	Diesel truck at 15 meters; noisy urban daytime
70 – 80	Shouting at one meter; vacuum cleaner at three meters	Gas lawnmower at 30 meters
60 – 70	Normal speech at one meter	Commercial area heavy traffic at 100 meters
50 – 60	Large business office; dishwasher next room	
40 – 50	Small theater or large conference room (background)	Quiet urban nighttime
30 - 40	Library (background)	Quiet suburban nighttime
20 - 30	Bedroom at night	Quiet rural nighttime
10 - 20	Broadcast and recording studio (background)	
0 – 10	Threshold of hearing	

dBA = A-weighted Decibel.

Table 3-9. Noise levels of heavy construction equipment.

Equipment Item	Maximum Noise Level (dBA) at 15 m (50 ft)	Equipment Item	Maximum Noise Level (dBA) at 15 m (50 ft)
All other equipment > 5 Horsepower	85	Gradall	85
Auger Drill Rig	85	Grader	85
Backhoe	80	Horizontal Boring Hydraulic Jack	80
Bar Bender	80	In-situ Soil Sampling Rig	84
Boring Jack Power Unit	80	Jackhammer	85
Chain Saw	85	Paver	85
Compactor (ground)	80	Pickup Truck	55
Compressor (air)	80	Pneumatic Tools	85
Concrete Batch Plant	83	Pumps	77
Concrete Mixer Truck	85	Rock Drill	85
Concrete Pump	82	Scraper	85
Crane (mobile or stationary)	85	Slurry Plant	78
Dozer	85	Slurry Trenching Machine	82
Dump Truck	84	Soil Mix Drill Rig	80
Excavator	85	Tractor	84
Flat Bed Truck	84	Vacuum Excavator (vac-truck)	85
Front End Loader	80	Vacuum Street Sweeper	80
Generator (25 KVA or less)	70	Vibratory Concrete Mixer	80
Generator (more than 25 KVA)	82	Welder	73

dBA = A-weighted decibel m = meters ft = feet

SOURCE: Commonwealth of Massachusetts, Section 721.560 Construction Noise Control - http://www.nonoise.org/resource/construc/bigdig.htm

3.6.4 Unexploded Ordnance

Several areas on VAFB were used as ordnance training ranges and have the potential to contain unexploded ordnance (UXO). Since ordnance can be found in several areas on Base, the Explosive Ordnance Disposal (EOD) Flight must coordinate on all ground disturbing projects. According to EOD guidance, if ordnance is found on-site, it should not be disturbed. Workers in the vicinity must be alerted to the danger and directed away from it, and the EOD Flight must be contacted.

3.7 Land Use and Aesthetics

Visual resources and landscape elements on VAFB include natural features such as gently rolling hills, canyons, creeks, sand dunes, and beaches. Man-made features on Base include the airfield, launch pads, residential development, industrial facilities, and other structures typical of a military installation. Visual resource sensitivity is dependent on the type of user, the amount of use, and viewer expectations. Because the mission of VAFB is the development of U.S. space and missile programs, viewers are familiar with the existing man-made features on Base associated with these programs. San Antonio Creek lies partially within VAFB boundaries; however the stretch of the creek within the proposed project area can be accessed by

the general public (via Hwy 1, Lompoc-Casmalia Road, and San Antonio Road West) and is not within a restricted area.

VAFB accommodates agricultural outleasing as a major land use on Base. At present, 28,296 acres of rangeland are leased for grazing, and 1,661 acres for cropland (VAFB 2007). All grazing land and farmland at VAFB is currently leased to the U.S. Department of Justice, Bureau of Prisons, U.S. Penitentiary in Lompoc.

The area near the proposed project area is characterized by open space, with dryland farming and cattle grazing occurring within and adjacent to site. Other nearby land uses include a firing range and water treatment plant (Water Plant #2). The firing range is located on the south side of San Antonio Road West, east of Lompoc-Casmalia Road, and is used for weapons training of military personnel. No recreational use of the firing range is allowed. The water treatment plant is located south of the Lee Road Utility Bridge, across from San Antonio Road West, and includes water treatment and storage facilities.

The proposed restoration area lies within a portion of San Antonio Creek adjacent to San Antonio Road West, in a deeply entrenched meandering creek channel with lush mature willow riparian vegetation on the creek banks. Because the creek is so deeply cut into the San Antonio Valley floor, views of the creek bed and proposed project sites are only visible near the edge of the creek channel, or from Hwy 1, on a grade ascending the Purisima Hills.

Coastal Zone Management

Federal activity in, or affecting the California coastal zone, requires preparation of a Coastal Zone Consistency Determination or a Negative Determination, in accordance with the federal Coastal Zone Management Act of 1972. The California Coastal Zone Management Program was formed through the California Coastal Act of 1972. The Air Force is responsible for making final coastal zone consistency determinations for its activities within the state. The California Coastal Commission reviews federally authorized projects for consistency with the California Coastal Zone Management Program.

On VAFB, the coastal zone extends inland from approximately 0.75 mi at the northern boundary to 4.5 mi at the southern end of Base. The project area under the Proposed Action is located approximately 3 mi inland, and is not within the California Coastal Zone. However, given potential, temporary, downstream effects during implementation the Proposed Action, the Air Force will request concurrence from the California Coastal Commission with a Negative Determination.

3.8 Transportation

VAFB is located approximately 5 mi west of the City of Lompoc. As shown in Figure 1-1 (Chapter 1), the main access route to VAFB is Hwy 101. Hwy 101 is a coastal four-lane divided freeway connecting northern California to southern California. The VAFB connections to Hwy 101 are Hwy 1, SR 135, and SR 246. Hwy 1, a north-south highway, traverses VAFB and provides access to Santa Maria to the northeast, and Santa Barbara to the southeast. When used in conjunction with Hwy 101, SR 246, an east-west highway, provides access to Lompoc to the east, and Santa Barbara to the southeast. SR 135 and SR 246 are mostly two-lane undivided highways with four-lane rural expressway portions.

Roadways in the vicinity of the project area lie within the jurisdiction of VAFB and the California Department of Transportation (Caltrans). These roadways include Hwy 1, San Antonio Road West, Richmond Road, and Sheridan Road.

VAFB is a federal military installation, and access to portions of Base is only permitted to authorized military personnel and their families, civilian employees of Base with approved identification, and visitors with pre-

approved authorization. Roadways within the project area are not restricted to public access, except during special military events or operations.

Exiting roadway conditions are evaluated based on roadway capacity and traffic volume. The capacity, which reflects the ability of the network to serve the traffic demand of a roadway, depends on the roadway width, number of lanes, intersection control, and other physical factors. A road's ability to accommodate different volumes of traffic is generally expressed in terms of Level of Service (LOS). The LOS scales range from A to F, with each level defined by a range of traffic volume to roadway capacity. LOS A, B, and C are considered good operating conditions with minor to tolerable delays experienced by motorists. LOS D represents below-average conditions. LOS E reflects a roadway at maximum capacity, and LOS F represents traffic congestion. Most roads on VAFB operate at a LOS between A and C (VAFB 2007).

Access to Project Site

The proposed creek restoration area is adjacent to San Antonio Road West. Project personnel and equipment would access this area via Hwy 1, turning onto San Antonio Road West from Hwy 1. San Antonio Road West is a 34-foot-wide, two-lane roadway with paved shoulders. This roadway is an east-west roadway that connects Hwy 1 with Lompoc-Casmalia Road. East of Lompoc-Casmalia Road, San Antonio Road West carries 733 average daily trips and operates in the LOS A range (USAF 2002). During the construction period, which is estimated to be 7 to 10 weeks, San Antonio Road West would be restricted to one lane.

Construction Trucks Haul Routes

The proposed creek restoration would require large quantities of imported stone, which would be obtained primarily from a borrow area located on Curly Road on north VAFB, and quarries located in Santa Margarita (San Luis Obispo County), and Corona (Riverside County). Currently, truck access to the Curly Road borrow pit is through the Solvang Gate and Lompoc Gate. Truck traffic associated with the proposed project in the region (Santa Barbara County) would use Hwy 101, Hwy 1, SR 135, and SR 246. The proposed route for construction equipment to/from the restoration area is shown in Figure 3-2.

3.9 Water Resources

Water resources include surface water and groundwater and their physical, chemical, and biological characteristics. Surface water includes lakes, rivers, streams, and wetlands, while groundwater refers to water below the surface.

In California, the State Water Resources Control Board (SWRCB) and the RWQCB administer the state NPDES Program. Section 402 of the CWA mandates the NPDES program, and U.S. EPA regulations provide the authority and framework for state regulations. The NPDES Construction General Permit regulates construction sites of 1 acre or more in California, and ensures that water discharged from a site meets water quality standards. State regulations require a Waste Discharge Requirement (WDR) for permitting discharge.

The Central Coast RWQCB is the local agency responsible for the VAFB area. The Central Coast RWQCB Water Quality Control Plan (Basin Plan) provides a framework for establishing beneficial uses of water resources and the development of local water quality objectives to protect these beneficial uses.

The major freshwater resources of the VAFB region include six streams, comprising two major and four minor drainages. The major drainages are San Antonio Creek and the Santa Ynez River. The minor drainages include Shuman, Bear, Cañada Honda, and Jalama Creeks. San Antonio Creek and the Santa Ynez River are the primary collection basins for runoff from VAFB. Although their collection basins are extensive, flow in these

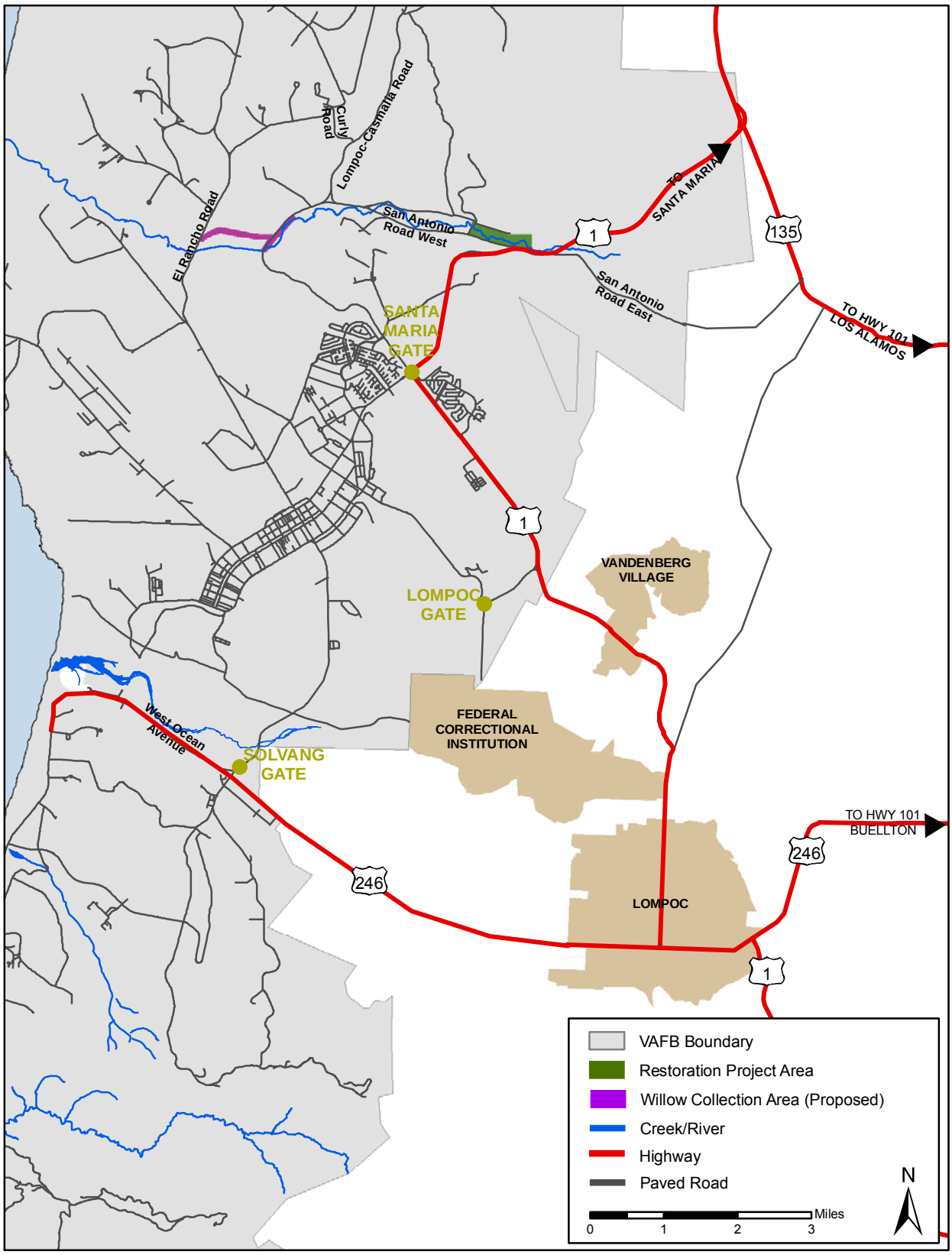

Figure 3-2. Main access and transportation routes associated with the Proposed Action.

two streams is seasonal because of low precipitation and upstream damming.

The general storm water rainy season at VAFB is from 1 October to 15 April. This timeframe has the greatest potential of site pollutant runoff. The average annual rainfall is approximately 14.8 inches (unpublished data, 30 SW).

3.9.1 Surface Water

San Antonio Creek drains an area of approximately 154 mi^2, flowing westward and discharging into the Pacific Ocean. The San Antonio Creek watershed consists of mostly undeveloped brushlands, rangelands, and agricultural fields.

Flow in San Antonio Creek is seasonal because of generally low precipitation from June to November. Higher discharges generally occur during the rainy season. The majority of the flow in San Antonio Creek is intermittent; however, the portion of the creek west of Barka Slough receives water emerging from groundwater seepage and has perennial flow due to a subsurface barrier, although at times very low. The amount of groundwater seepage into San Antonio Creek decreases as the amount of groundwater pumped in the upstream valley increases.

3.9.2 Sediment

The bed profile and channel shape of San Antonio Creek is actively changing between Barka Slough and the Pacific Ocean. Within the proposed project area, the creek channel has eroded and downcut (deepened through erosion) as much as 11 ft from 1993 through 2005 (HDR 2008). Peak sediment loads occur during the wet season due to the increased flow at that time.

3.9.3 Floodplain

The 100-year floodplain for the San Antonio Creek basin was defined by FEMA and is depicted in Figure 3-3.

3.9.4 Hydraulics

In 2002, Tetra Tech completed a hydraulic analysis of San Antonio Creek (Tetra Tech 2002). The analysis was based on annual peak flow data obtained from the USGS Water Resources Data Report for California Water Year 2003 (October 1, 2002 to September 30, 2003) from gage 11136100, located at the San Antonio Road West Bridge, approximately 1.6 mi upstream from the Lompoc-Casmalia Road Bridge. The drainage area upstream of the gage location is 135 mi^2.

Peak flows were determined using the Hydrologic Engineering Center Flood Frequency Analysis computer model for the 2-, 5-, 10-, 25-, 50-, and 100-year return period. Table 3-10 presents the peak discharges for various return-period storm events. The largest peak flow was recorded in February 1998 at 3,260 cubic feet per second (cfs; Table 3-11 [USGS 2008]).

Table 3-10. Peak flow rates at San Antonio Road West Bridge.

Return Period (Years)	Peak Flow (cfs)*
100	9,350
50	5,990
25	3,700
10	1,770
5	900
2	255

* cfs = Cubic feet per second

Table 3-11. Peak flows of San Antonio Creek at the San Antonio Road West Bridge from February 1998 to March 2003.

Month	Year	Total (cfs)*
February	1998	3,260
March	1999	332
February	2000	793
March	2001	2,740
November	2001	127
March	2003	178

* cfs = Cubic feet per second

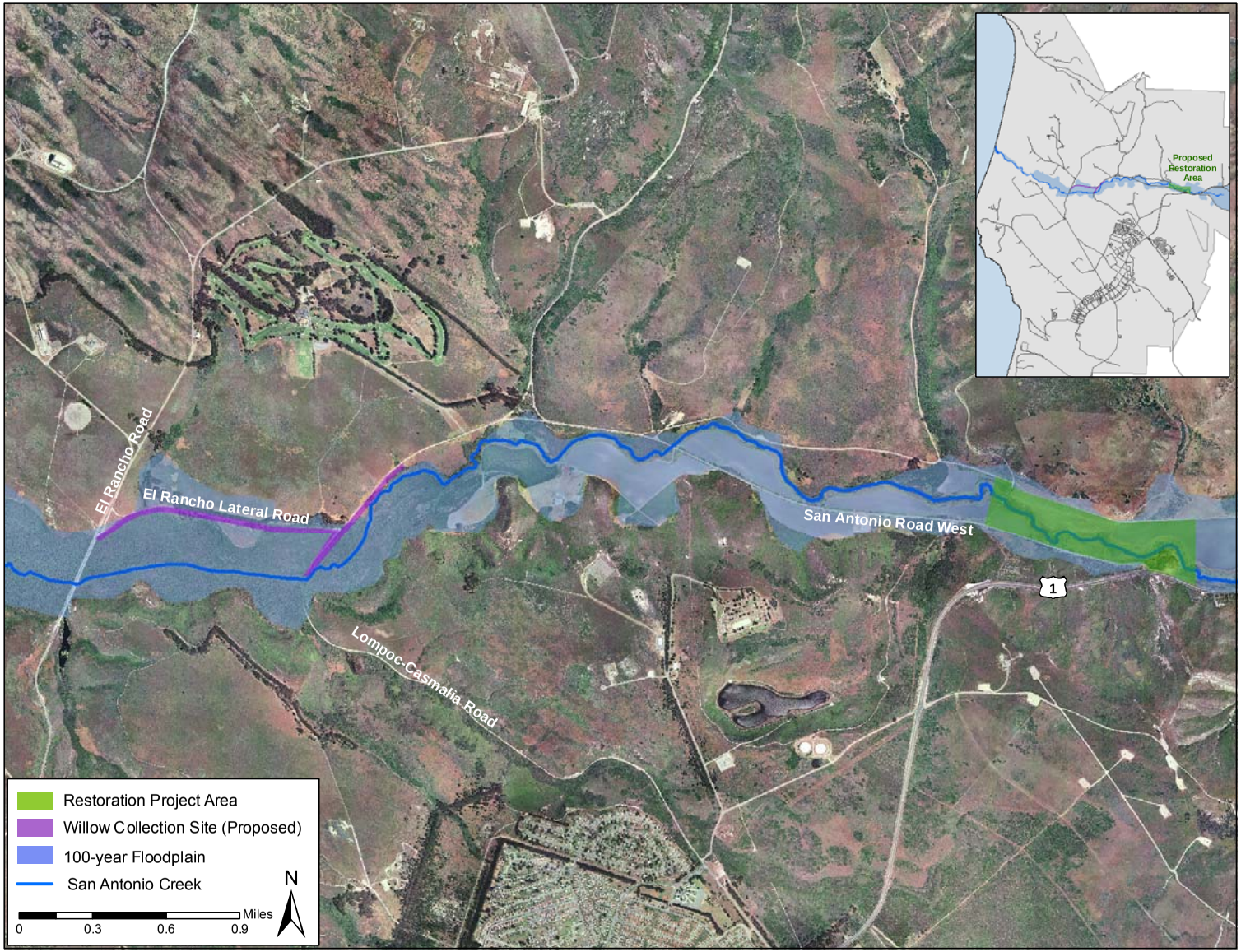

Figure 3-3. San Antonio Creek 100-year floodplain.

3.9.5 Groundwater

Groundwater in the San Antonio Creek Valley occurs in most of the unconsolidated deposits (deposits through which water flows easily) that have filled the San Antonio Trough (a notch cut through the consolidated Tertiary rocks by San Antonio Creek). The water-bearing deposits in San Antonio Creek include alluvium, Orcutt Sand, the Paso Robles Formation, and Careaga Sand.

Groundwater in the area moves from the hills surrounding the San Antonio Creek Valley toward the center of the valley, and from there west to the Pacific Ocean. At Barka Slough groundwater rises to the surface, creating a freshwater marsh, and flows westward into San Antonio Creek as surface flow. Within the proposed project area west of Barka Slough, the movement of groundwater is restricted to a thin, narrow strip of alluvium that has filled a notch cut through the consolidated Tertiary rock by San Antonio Creek.

Vineyards and other agricultural properties located upstream of VAFB draw water from the Paso Robles Formation and other unconsolidated formations. Groundwater levels within the proposed project area vary seasonally due to changes in runoff, storm conditions, and wells upstream that pump groundwater for irrigation. Stream flow during the wet season is derived primarily from rain runoff and tributaries. During the dry season the flow may be primarily derived from groundwater discharge from Barka Slough. The groundwater depth within the proposed project area is within 10 ft of the creek bed (Fugro 2006).

The groundwater downstream of Barka Slough is relatively high in hydrogen sulfide, with total dissolved solid (TDS) concentrations up to 2,430 milligrams per liter (mg/L), as measured from 2001 through 2003 (USGS 2008). These TDS concentrations are in excess of acceptable drinking water standards; however, the groundwater is suitable for drinking water purposes with the addition of chlorine and fluorine. In addition, groundwater in this area has a sodium level that is beyond the limits for safe irrigation use (Muir 1964).

The VAFB water supply primarily comes from water purchased from the California Department of Water Resources State Water Project. Aquifers capable of yielding large quantities of water usable for water supply are generally restricted to the deeper portions of the Santa Ynez River and San Antonio Creek (USAF 1998). Four groundwater production wells located in the San Antonio Creek-Barka Slough area are used to supplement the VAFB state water during annual maintenance periods. The greatest threat to groundwater is contamination from hazardous material or waste releases that could infiltrate an aquifer. Groundwater from the San Antonio Creek basin supplies water for irrigation, domestic, industrial, and municipal purposes through pumping. The only local ground drinking water sources are the water wells located near Barka Slough, which are approximately 2 mi upstream from the creek restoration area.

3.9.6 Water Quality

Water quality objectives for water bodies within the Central Coast are established in the Central Coast RWQCB Basin Plan. The Central Coast RWQCB, through its Central Coast Ambient Monitoring Program, monitors water quality parameters in San Antonio Creek. Monitoring data is used to evaluate beneficial use support in the surface waters of the region. Main objectives are to evaluate the safety of surface waters for swimming, drinking, aquatic life, agricultural uses, and aesthetic and non-contact recreational uses. Healthy creek systems can be expected to carry sediment loads during high flows; thus, total suspended solids (TSS) will be elevated during storm events. Depressed dissolved oxygen (DO) levels typically are prevalent in summer and early fall when the temperatures are higher and water levels are low.

Water sample locations include the San Antonio Road West crossing of San Antonio Creek on VAFB, approximately 1 mi

downstream from the proposed creek restoration area. The mean TSS of 23 samples collected at this water sample location, from January 2001 through October 2004, was approximately 273 mg/L. The mean for DO of 26 samples collected between January 2001 and December 2004 was 9.4 mg/L. Detailed results and additional data on water quality in San Antonio Creek are accessible through the Central Coast Ambient Monitoring Program website at http://www.ccamp.org.

Section 303(d) of the federal CWA requires states to identify surface water bodies that are polluted (water quality limited segments). These surface water bodies do not meet water quality standards even after discharges of wastes from point sources have been treated by the minimum required levels of pollution control technology. Wastewater treatment plants, a city's storm drain system, or a boat yard, are a few examples of point sources that discharge wastes to surface waters. San Antonio Creek is on the 2006 CWA Section 303(d) List of Water Quality Limited Segments. The creek is impaired due to sedimentation, ammonia, nitrate and boron.

Chapter 4. Environmental Consequences

This chapter presents the results of the analysis of potential environmental effects of implementing the Proposed Action and No-Action Alternative as described in Chapter 2. For each environmental component, anticipated impacts are assessed considering short- and long-term effects.

4.1 Air Quality

The criteria for determining the significance of air quality impacts are based upon federal, state, and Santa Barbara County standards and regulations. Impacts would be considered significant if project emissions increase ambient pollutant concentrations from below the NAAQS or CAAQS to above these standards, or if they contribute measurably to an existing or projected ambient air quality standard violation.

In non-attainment or maintenance areas, federal agencies are required to prepare a conformity determination to prevent federal actions from causing an exceedance of a national ambient air quality standard. To reduce the time and resources federal agencies expend in preparing conformity determinations, the U.S. EPA developed de minimis levels that serve as thresholds for focusing on those actions likely to have the most significant impacts. The U.S. EPA deemed that emission levels below the de minimis levels were not significant.

As of June 15, 2005, Santa Barbara is in attainment of or unclassifiable for all federal air quality standards. Federal agencies are no longer required to prepare conformity determinations. In Santa Barbara County under the approved Maintenance Plan the Proposed Action may not emit greater than the *de minimis* threshold of 100 tons per year (tons/yr) of NO_X or VOCs. VAFB believes all threshold levels used in conformity determinations are relevant for use as thresholds for determining if air quality impacts would be significant. The rationale used by the U.S. EPA to develop the thresholds for non-attainment areas is no less applicable for areas in attainment when considering criteria pollutants. Using a 365 day year, these *de minimis* levels equate to significance levels of 548 pounds per day (lbs/day) of NO_X, and 548 lbs/day for VOCs. These are the levels (100 tons/yr or 548 lbs/day) of NO_x or VOCs VAFB will use for determining whether or not air quality impacts are significant.

4.1.1 Proposed Action

The Proposed Action consists of installing in-stream rock-riffle grade controls at seven sites, and bioengineering bank stabilization at three of the grade control sites in San Antonio Creek, as detailed in Chapter 2 of this EA. Proposed construction activities are assumed to occur during calendar year 2008 and last for 40 days. Fugitive dust emissions generated from equipment operating on exposed ground and combustive emissions from the equipment would cause adverse air quality impacts. The largest adverse impacts would occur when vehicles disturb the soil on-site; smaller impacts would occur during the transport of construction debris and material handling. Factors needed to derive construction source emission rates were obtained from the South Coast Air Quality Management District's (SCAQMD) *CEQA Air Quality Handbook* (SCAQMD 1999), and the CARB URBEMIS 2007 Model (Jones & Stokes Associates 2007), and EMFAC2007 BURDEN Model (CARB 2007).

The proponent prepared a list of construction equipment and anticipated usages, which was used to prepare the detailed air emission inventory presented in Appendix B. The

construction equipment list is presented in Appendix B, Table B-1, while the emission factors used to estimate the emission are found in Table B-2. For purposes of this analysis, it was estimated that 1 acre per day would be disturbed. It was further estimated that on a reasonable worst-case day, 3 acres would be disturbed. With a disturbance of up to 10 hours per day, the reasonable worst-case day fugitive dust emissions would be 104.7 pounds (lbs) of PM_{l0} per day. These emissions would not be expected to cause an exceedance of any ambient air quality standard; therefore, there would be no significant impacts from PM_{10}.

The methodology and assumptions used to calculate emissions from the Proposed Action are presented in Appendix B. Tables B-3 and B-4 present the daily and total project emissions from construction activities, respectively. The daily emissions were estimated to be 153.27 lbs of CO, 438.64 lbs of NO_x, 126.77 lbs of PM_{10}, 29.98 lbs of ROC, and 0.43 lbs of SO_x. Total project emissions were estimated to be 2.40 tons of CO, 5.49 tons of NO_x, 1.02 tons of PM_{10}, 0.66 tons of ROC, and 0.01 tons of SO_x. Emissions from the Proposed Action would not exceed the significance thresholds of 548 lbs/day or 100 tons/yr. Therefore, no adverse impacts to the region's air quality should occur from the Proposed Action.

4.1.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Air Quality during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- Before construction begins for the Proposed Action, portable equipment meeting the criteria defined in the *Final Regulation Order,* effective September 12, 2007 for the California Portable Equipment Registration Program would be registered in the program or have a valid SBCAPCD Permit to Operate.
- Portable diesel equipment would comply with the Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Rated at 50 horsepower and Greater, dated September 12, 2007.
- Equipment usage and fuel consumption would be documented and reported to the 30 CES/CEV to facilitate tracking construction emissions for inclusion in the VAFB Air Emissions Inventory.
- Idling of heavy-duty diesel trucks during loading and unloading shall be limited to 5 minutes, with auxiliary power units used whenever possible.

Although significant emissions would not occur from the Proposed Action, the following SBCAPCD dust control measures would be implemented to further decrease fugitive dust emissions from ground disturbing activities:

- Water would be applied at least twice daily to dirt roads, graded areas, and dirt stockpiles to prevent excessive dust at the staging areas. Watering frequency would be increased whenever the wind speed exceeds 15 mph. Chlorinated water would not be allowed to run into any waterway.
- Vehicle speeds would be minimized on exposed earth.
- Ground disturbance would be limited to the smallest, practical area and to the least amount of time.
- The Storm Water Pollution Prevention Plan (SWPPP), including Best Management Practices (BMPs) to reduce dust emissions, and the Environmental Protection Plan (EPP), which includes dust control compliance measures, would be implemented.
- If importation, exportation, and stockpiling of fill material are involved, soil stockpiled for more than 2 days would be covered, kept moist, or treated with soil binders to prevent dust generation. Trucks transporting fill material to and from the site would be tarped from the point of origin.

In addition to the above dust control measures, the following control measures would be implemented to decrease diesel emissions. Diesel engines operated in California are required to meet CARB established standards which may be more stringent than federal mandates.

- When feasible, equipment powered with federally mandated ultra-low sulfur diesel engines would be used.
- Engine size in equipment used for the project would be minimized.
- The use of equipment would be managed to minimize the number of pieces of equipment operating simultaneously and total operation time for the project.
- Engines would be maintained in tune per manufacturer or operator specification.
- CARB-certified diesel fuel would be used.
- If feasible, U.S. EPA or CARB-certified diesel catalytic converters, diesel oxidation catalysts, and diesel particulate filters would be installed.
- CARB-developed idling regulations for trucks during loading and unloading would be followed.
- When applicable, equipment powered by diesel engines retrofitted or re-engined to meet the *Air Toxics Control Measures for Off-Road Vehicles* would be used.
- Given the requirements of EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and the increasing concerns that greenhouse gases contribute to Global Climate Change, the 30 CES/CEV will take into consideration and encourage measures that promote efficiency and conservation through education, programs, and incentives to increase efficiency and conserve energy in projects on VAFB.

4.1.3 No-Action Alternative

Under the No-Action Alternative, there would be no activities associated with creek restoration. Therefore, no impacts to air quality would occur as a result of emissions associated with project activities.

4.2 Biological Resources

Impacts to biological resources would occur if special status species (i.e., endangered, threatened, rare, or candidate) or their habitats, as designated by federal and state agencies, would be directly or indirectly affected by project-related activities. In addition, impacts to biological resources are considered adverse if substantial loss, reduction, degradation, disturbance, or fragmentation would occur in native species habitats or in their populations. These impacts can be short- or long-term impacts, such as short-term impacts from noise and dust during construction, and long-term impacts from the loss of vegetation and, consequently, loss of the capacity of habitats to support wildlife populations.

4.2.1 Proposed Action

The Proposed Action would potentially result in disturbance to approximately 105.49 acres within the restoration area. In addition, willow collection would occur within approximately 22.35 acres of willow riparian habitat near the El Rancho Lateral Road-Lompoc Casmalia Road intersection. Project activities would last approximately 7 to 10 weeks. These activities have the potential to result in short-term, temporary, adverse effects to biological resources in the immediate area of disturbance, and long-term, permanent, beneficial effects from improved habitat and ecological function. Specific effects of implementing the Proposed Action on botanical and wildlife resources are discussed in more detail below, and potential related effects to special status species are summarized in Table 4-1. Measures to minimize or avoid adverse effects on natural resources and special status species during project implementation are summarized in Section 4.2.2, Environmental Protection and Monitoring Measures.

Table 4-1. Potential Proposed Action related effects on special status species.

Scientific Name **Common Name**	**Status**		**Occurrence**	**Potential Effects**
	USFWS[1]	**CDFG[2]**		
Plants				
Deinandra increscens ssp. *villosa* Gaviota tarplant	FE	SE	Potential	Loss of individuals and seed bank.
Fishes				
Gasterosteus aculeatus williamsoni Unarmored threespine stickleback	FE		Documented	Temporary decrease of habitat quality due to turbidity; entrapment in project area. Long-term increase in availability of quality habitat.
Amphibians				
Rana aurora draytonii California red-legged frog	FT	CSC	Documented	Temporary loss of habitat; disturbance due to noise; entrapment in project area; temporary decrease of habitat quality due to turbidity. Long-term increase in availability of quality habitat.
Invertebrates				
Euphilotes battoides allyni El Segundo blue butterfly	FE		Potential	Loss of eggs, larvae, and pupae, and host plant seacliff buckwheat.
Birds				
Agelaius tricolor Tricolored blackbird	BCC	CSC	Documented	Disruption of foraging and roosting activities. Long-term increase in availability of quality habitat.
Lanius ludovicianus Loggerhead shrike	BCC	CSC	Documented	Disruption of roosting and foraging activities.
Reptiles				
Actinemys marmorata Western pond turtle		CSC	Documented	Disruption of resting and foraging activities. Long-term increase in availability of quality habitat.

NOTES:
1 FE = Federal Endangered Species FT = Federal Threatened Species BCC = Federal Bird of Conservation Concern
2 SE = California Endangered Species CSC = California Species of Concern

4.2.1.1 Botanical Resources

Potential effects to plant communities and plant species include:

- Short-term (temporary) and long-term (permanent) loss of habitat from construction related activities such as access, excavation, and placement of rock riprap.
- Loss of individuals within project areas due to excavation, crushing or burial.
- Loss of individuals in habitats adjacent to work areas due to soil erosion.
- Soil erosion in wetlands or open water within and adjacent to the restoration area.
- Long-term increase of habitat value.

Approximately 86.56 acres of natural vegetation types occur within the proposed restoration and willow collection areas, and have the potential to be affected as a result of project activities. Temporary disturbances to these vegetation types would be unavoidable during installation of temporary access roads and staging areas, installation of grade control and bank stabilization structures, excavation of floodplain terraces, and collection of branch cuttings.

Vegetation greater than 2.5 inch-diameter would be mechanically cleared and smaller vegetation (less than 2.5-inch-diameter) would be crushed. To the extent feasible and possible, root systems would be left intact. Native topsoil and subsoil would be salvaged during excavation and grading, except in

areas with a seed bank likely dominated by undesirable weed species. Soil excavated within the project area would be used as fill within project sites to minimize introducing non-native soils into the creekbed.

Removal of vegetation, and temporary disturbances to natural vegetation types would be necessary during project implementation, and considered a significant impact without mitigation. However, the removal of native vegetation would be minimized, and native vegetation would be replanted to restore all disturbed areas. As much as feasible, vegetation removal would be restricted to the minimum areas possible, and restricted to the level of the bottom substrate, with root systems left in place to encourage vegetation re-sprouting after completion of construction activities. In addition, BMPs required as part of the NPDES Construction General Permit would be implemented to control erosion and reduce turbidity during construction.

Live branch cuttings would be incorporated during construction and restoration of native vegetation types would be implemented during project activities. Areas disturbed by construction activities would be restored to an ecologically functional state that supports the same local plant and animal species found in adjacent natural areas. Maintenance (e.g., weeding and re-seeding) and monitoring would ensure the successful restoration of native vegetation types and wetland habitats, to the maximum extent possible. Areas proposed for restoration under the Proposed Action are expected to return to self-sustaining native vegetation types. Therefore, impacts to botanical resources should be less than significant.

4.2.1.2 Wildlife Species

The potential adverse effects to wildlife species associated with the Proposed Action include:

- Short-term (temporary) and long-term (permanent) loss of habitat from construction related activities such as access, excavation, and removal of vegetation.
- Loss of individuals within the work area due to excavation, crushing or burial.
- Loss of individuals in habitats adjacent to work areas due to soil erosion.
- Short-term (temporary) abandonment of roosting sites due to project-related noise and associated disturbance.
- Disruption of foraging or roosting activities due to project-related noise and associated disturbance.
- Soil erosion into open water adjacent to the project site.
- Degradation of water quality due to turbidity.
- Long-term (permanent) benefits from improved habitat and a healthier riparian ecosystem.

Wildlife, including mammals, amphibians, reptiles, and birds, present in the vicinity of the restoration activities could be affected by project-generated noise. Wildlife response to noise can be physiological or behavioral. Physiological responses can range from mild, such as an increase in heart rate, to more damaging effects on metabolism and hormone balance. Behavioral responses to man-made noise include attraction, tolerance, and aversion. Each has the potential for negative and positive effects, which vary among species and individuals of a particular species, due to temperament, sex, age, and prior experience with noise. Responses to noise are species-specific; therefore, it is not possible to make exact predictions about hearing thresholds of a particular species based on data from another species, even those with similar hearing patterns.

Potential impacts to wildlife species from human presence, project-generated noise, and disturbance associated with project implementation include temporary disruption of foraging and roosting activities and loss of habitat. Wildlife species would be expected to move away from the areas of disturbance during restoration activities. These disturbances would be considered short-term and temporary, and would not be considered

of a magnitude to result in adverse impacts to populations within the vicinity of the project areas, given the availability of ample habitat available in the surrounding areas. Areas proposed for restoration under the Proposed Action are anticipated to return to natural vegetation types, and wildlife species are expected to return to these areas.

The Migratory Bird Treaty Act provides federal protection to native avian species, their nests, eggs, and unfledged young. Restoration activities would occur from approximately August 25 to October 15, which is past the breeding season for avian species known to breed within the project area.

4.2.1.3 Sensitive Vegetation Types and Special Status Species

The proposed restoration project would result in the temporary disturbance of riparian and wetland habitat within the creek bed and banks due to project-related activities. A wetland delineation was completed in April 2008 that provides accurate acreages of disturbance to these habitats (Appendix D). Section 4.2.1.4 below provides additional details on impacts to these vegetation types. These areas are proposed for habitat restoration and are anticipated to return to natural plant communities.

Formal section 7 consultation for federally listed species with potential to be affected was completed on 29 July 2008. The completed consultation was in the form of a Biological Opinion issued by USFWS (see Appendix C). VAFB will wholly adopt all mitigation measures stipulated within the Biological Opinion.

Unarmored Threespine Stickleback and California Red-legged Frog

Changes in water flow, draining of areas with ponded water, increases in sedimentation, and removal of riparian vegetation have the potential to adversely impact unarmored threespine stickleback and California red-legged frog habitat. The water quality and quantity, substrate, and vegetative overstory, have the potential to be affected within and downstream of the project area. The Air Force proposes to minimize the release of fine sediments during construction by implementing appropriate erosion control measures.

The proposed project may disrupt and reduce the prey base of unarmored threespine sticklebacks and California red-legged frogs. Temporary pulses of suspended sediment during construction may cover algae and suffocate bottom dwelling organisms. Subsequently, a reduction in prey species may lead to increased competition for food. Proper implementation of methods to reduce sedimentation would reduce impacts to the prey base.

Contamination of unarmored threespine stickleback and California red-legged frog habitat may occur during the application of soil binders, mulch, tackifiers, and fertilizers; spills and leaks from construction equipment; or discharge of construction related materials into the creek channel. The fertilizer Biosol® is not water soluble, and the nitrogen is unavailable for water transport. This fertilizer is released biologically to the plants and not the soil (Rocky Mountain Bio Products 2008). Additionally, the Air Force proposes to implement measures to minimize erosion and the possibility of accidental spills into waterways. Pipes used for temporary containment of creek flows would be capped off and buried under construction materials during project implementation, or to a depth to prevent scour after project activities. Implementation of minimization measures during project activities should minimize the potential for adverse effects, while restoration of riparian and upland habitat and revegetation of disturbed sites within the project area should provide beneficial effects to California red-legged frogs and unarmored threespine stickleback.

Unarmored threespine sticklebacks and California red-legged frogs would be captured and relocated prior to project implementation. Thus, adverse effects to these species would be minimized. California red-legged frogs in the vicinity of project sites would be expected

to move away from the areas of disturbance during restoration activities. These disturbances would be considered short-term and temporary and would not be considered of a magnitude to result in adverse impacts to populations within the vicinity of the project area.

California red-legged frogs and unarmored threespine sticklebacks may be injured or killed during capture and relocation efforts, by foot or equipment traffic, predators attracted to work areas, or as a result of contamination of habitat. Pre-construction surveys would be conducted for unarmored threespine stickleback within the restoration area to determine approximate population estimates and quantify the effects of the proposed project on this species. The proposed minimization measures should ensure that California red-legged frogs and unarmored threespine sticklebacks are protected, and that potential for injury is averted as much as possible.

El Segundo Blue Butterfly

Surveys have not been conducted during the flight period for El Segundo blue butterfly (June through September) in the vicinity of the project area, thus it is unknown whether this species occurs within or near the area. Surveys would be conducted within known occupied habitat on VAFB to determine the 2008 flight period. Pre-construction surveys would be conducted within the project area during this period to positively identify the presence of this species and quantify the effects of the proposed project.

Project activities would occur between approximately August 25 and October 15, partially during the flight period for the El Segundo blue butterfly (June through September), and could result in disturbance and mortality of adult butterflies. The destruction of seacliff buckwheat during the June through September period when eggs or larvae may be present could result in mortality of these life stages. Vehicle traffic and other activities causing soil compaction have the potential to crush dipausing pupae. Adverse effects to butterfly adults, eggs, larvae and pupae, if present, and to its host plant, seacliff buckwheat, would be avoided by isolating and protecting individual plants from disturbance.

Gaviota Tarplant

Activities associated with the proposed creek restoration that could adversely affect Gaviota tarplant include excavation, installation of access roads and staging areas, and disturbance as a result of vehicles driving over the plants for access to project sites. Because restoration activities would partially occur during the flowering period for Gaviota tarplant (May to September), potential adverse effects associated with these activities include loss of individual Gaviota tarplants and their seeds.

Because Gaviota tarplant could not be positively identified due to absence of flowers during the biological surveys for this project, precise estimates of affected Gaviota tarplant habitat could not be calculated. Gaviota tarplant may occur in low quality habitat represented by the ruderal community within the project area, which is subject to continuous disturbance such as road maintenance. Approximately 0.04 acre of suitable Gaviota tarplant habitat was identified as having the potential to be affected by the proposed project. Pre-construction surveys would be conducted during the peak blooming period (June through September) at all project sites to positively identify the presence of this species and quantify the effects of the proposed project.

Individual plants documented during these surveys would be isolated and protected from disturbance, if possible. Individual plants present within these areas may be permanently lost, and the seed bank disturbed, which could delay or prevent the reestablishment of plants. However, individuals that occur within this ruderal habitat are isolated from high quality suitable habitat by nature of their location, and are restricted to a long, narrow corridor with no opportunity for expansion. Due to the small number of individuals that could be lost, and extensive distribution of Gaviota tarplant on VAFB, the loss of individuals and low quality

habitat within the proposed restoration area is unlikely to result in adverse effects to the species. Restoration of native vegetation types would be implemented during project activities.

Tricolored Blackbird and Loggerhead Shrike

Breeding activities of these avian species would not be disrupted due to the time of year when the project would be implemented. Disturbances resulting from the presence of human activity would disrupt roosting and foraging activities if birds are present within the project area. These disturbances would be short-term, and additional suitable habitat not subject to these temporary disturbances is available in the vicinity; thus, adverse effects should be less than significant.

Western Pond Turtle

Project activities would occur at the end of the breeding period for this species, thus it is unlikely that breeding activities would be affected. Western pond turtles may be present within project sites resting and foraging. Disturbances resulting from human presence would temporarily disrupt these activities. Additional suitable habitat not subject to these disturbances is available in the vicinity, thus adverse effects should be less than significant.

4.2.1.4 Waters of the United States and Wetlands

Impacts to jurisdictional waters of the U.S. and wetlands are considered significant if the project results in a net loss of wetland area or habitat value, either through direct or indirect impacts to wetland vegetation, loss of habitat for wildlife, degradation of water quality, or alterations in hydrological function.

Based on the wetlands delineation conducted from February through April 2008 (MSRS 2008) and the footprint for disturbance for the proposed project, it is anticipated that the Proposed Action would result in the direct disturbance of 4.75 acres of Waters of the U.S., including 3.18 acres of wetland habitat (freshwater marsh). A CWA Section 401 Water Quality Certification from the Central Coast RWQCB and CWA Section 404 Permit from the USACE would be required because direct impacts to water bodies or wetlands would occur. Live branch cuttings would be incorporated during construction and restoration of vegetation types would be accomplished during project implementation. Bank stabilization, including creation of floodplain terraces, would create an enhanced wetland habitat within the proposed restoration area. Preliminary estimates based on GIS analysis indicate approximately 0.67 acre qualifying as USACE jurisdictional wetland would initially be lost due to project implementation. However, over the next several years, the unvegetated streambed habitat will transition into jurisdictional wetland habitat as freshwater marsh reestablishes due to an expanded floodplain and slower stream velocity. VAFB will monitor the project area for 5 years to determine actual net gain and/or loss of unvegetated streambed, jurisdictional wetlands, and riparian woodland. Compliance with the conditions of the Section 401 and 404 permits will ensure no net loss of wetlands occurs. With these measures, impacts would be less than significant.

4.2.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Biological Resources during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- Qualified biologists would brief all project personnel prior to participating in project implementation activities. At a minimum, the training would include a description of the listed species occurring in the area, and the general and specific measures and restrictions to protect these species during project implementation, i.e., work area boundaries, access routes, and staging areas.

- All human generated trash at the project area would be contained and removed from the work site and disposed of properly at the end of each workday. All construction debris and trash would be removed from the project area upon completion of the project.

- All brush piles resulting from vegetation removal would be removed from the creek bed by the end of each workday.

- A schedule of planned construction activities would provided to the VAFB Biologist and Botanist, and the biological monitors, at least 48 hours in advance.

Botanical Resources

- Pre-construction surveys would be conducted during the peak blooming period (June through September) to positively identify the presence of Gaviota tarplant within the project area. Individual plants documented would be isolated and protected from disturbance, if possible.

- Where feasible, non-native wetland and riparian vegetation within the project area would be removed during project-related activities.

- All temporarily disturbed areas, including access roads, would be restored at a minimum to the original condition.

- Post-construction monitoring to assess the effectiveness of the initial revegetation efforts, ensure native species are established, and minimize the establishment of non-native invasive species, would be implemented for a period of 5 years.

Wildlife Resources

- Temporary containment of the active creek channel would occur through or around a project site, ensuring unimpeded creek flow through the project area.

- Approximately 1 week prior to containment of the creek channel, a qualified biologist would install exclusion nets and drift fencing to exclude unarmored threespine stickleback, California red-legged frogs, and other aquatic species from the project area.

- Exclusion nets would be set up within the main channel of San Antonio Creek approximately 50 ft upstream and 50 ft downstream of the project area. Exclusion nets would be checked daily to remove debris and ensure netting is still in good condition.

- Silt fencing, or other similar material, would be used to construct drift fences within the main channel of San Antonio Creek, approximately 50 ft upstream and 50 ft downstream of the project area, to exclude adult and sub-adult California red-legged frogs. Drift fences would be securely anchored at the bottom.

- After installation of the nets and drift fences, and within 2 days prior to construction activities, unarmored threespine stickleback, all lifestages of the California red-legged frog, and other aquatic species within the exclusion zone, would be captured and relocated downstream of the project area. The main channel of San Antonio Creek, as well as all side channels and isolated pools within the exclusion zone, would be repeatedly searched for these species.

- When possible, capturing and releasing of adult and sub-adult California red-legged frogs would be conducted during night surveys prior to construction activities, between 1 hour after sunset and midnight, during the period when California red-legged frogs are most active.

- Dipnets and minnow traps would be used to capture any overwintering California red-legged frog tadpoles around vegetation.

- Qualified biologists, approved by the USFWS and 30 CES/CEV, would be present to inspect work areas prior to the start of activities each day, and capture and relocate any unarmored threespine stickleback, California red-legged frogs, or other aquatic species that may be present.

- A screen (no larger than 0.125-inch mesh size) would be installed at the end of dewatering pumps to prevent entrapment of unarmored threespine stickleback and California red-legged frogs.

- California red-legged frogs and unarmored threespine sticklebacks captured during project activities would be transported and relocated to suitable habitat outside of the project area.
- Unarmored threespine stickleback would be monitored downstream of the project area before and intermittently during construction to assess possible downstream impacts.
- A contingency plan would be developed for the recovery and salvage of unarmored threespine stickleback, and California red-legged frogs, in the event of a local toxic spill or accidental dewatering of their habitat.
- To the maximum extent feasible, individuals of non-native species, such as bullfrogs, crayfish, and the centrarchid fishes, would be removed from the project area.
- Seacliff buckwheat, host plant of the El Segundo blue butterfly, would be isolated and protected from disturbance.

4.2.3 No-Action Alternative

Under the No-Action Alternative, restoration activities would not occur within San Antonio Creek on VAFB, and biological resources would not be directly affected by project activities. Implementation of this Alternative would result in significant long-term adverse effects on biological resources. Adverse effects to botanical and wildlife resources, including special status species, include the continued incision of the creek bed and banks, and further decline in the quality and quantity of native plant communities and wildlife habitat.

4.3 Cultural Resources

The Proposed Action is subject to compliance with all relevant authorities governing cultural resources, including Section 106 of the NHPA and Air Force Instruction (AFI) 32-7065. Compliance with Section 106 of the NHPA also satisfies federal agencies responsibilities for considering potential project related effects to cultural resources under the NEPA. Section 106 of the NHPA requires federal agencies to consider the effects of proposed federal undertakings on cultural resources that are listed in or eligible for listing in the NRHP (a.k.a. historic properties). Part of compliance with Section 106 requires the federal agency to determine either that the undertaking would have no effect to historic properties, no adverse effect to historic properties, or an adverse effect to historic properties (which would then require resolving). The Section 106 implementing regulations [36 CFR Part 800] prescribe the process for making these determinations.

4.3.1 Proposed Action

A complete inventory of cultural resources was performed within the proposed creek restoration area. The cultural resources investigation was a coordinated review that meets the requirements of Section 106 of the NHPA, and the NEPA.

Project activities were developed to avoid adverse effects to known resources, where feasible. However, one archaeological site (CA-SBA-3932) could not be avoided. Because the site is deeply buried, VAFB assumes the site is eligible for the NRHP for the purposes of the proposed project only. Therefore, VAFB has determined that the Proposed Action would have an adverse effect to one historic property. This determination and the associated studies are documented within a report on the identification of historic properties and assessment of adverse effects, which was submitted to the California State Historic Preservation Officer (SHPO) for review and a request for concurrence.

VAFB proposed measures to mitigate the project's adverse effects to acceptable levels with the SHPO and Santa Ynez Band of Chumash Indians, in compliance with Section 106 of the NHPA and AFI 32-7065. These measures were contained within a Historic Property Treatment Plan, accompanied by a Memorandum of Agreement (MOA). The Santa Ynez Band of Chumash Indians coordinated with VAFB on the details of the

Historic Property Treatment Plan and the MOA until both parties were in agreement. The SHPO approved VAFB's Historic Property Treatment Plan and MOA on September 2, 2008 (see Appendix E). The terms outlined in the Historic Property Treatment Plan and MOA will be fully implemented, including ongoing coordination with the Santa Ynez Band of Chumash Indians throughout the duration of the Proposed Action. In the event that previously undocumented cultural resources are discovered during project activities, procedures established in 36 CFR 800.13 would be followed.

The following sections discuss the consequences of implementing the Proposed Action on each cultural resource.

CA-SBA-1009

Project activities near CA-SBA-1009 would include the establishment of a temporary construction access road that runs from Sheridan Road southward across the agricultural field and through the middle of the site. The construction access road limits would be designated using orange mesh temporary fencing, stakes, or other readily visible marker as appropriate. Additionally, in the western edge of the site, there would be a boulder storage and delivery area. Dump trucks would deposit boulders onto the ground surface and an excavator with a "thumb" on the bucket would pick the boulders up and lower them into the creek bed, where another excavator would receive the boulder and deliver it to its final location. When construction is complete, all temporary work areas would be restored to their original condition to the maximum extent feasible and revegetated.

Three shovel test pits excavated along the proposed construction access road revealed a very low-density scatter of flaked stone debitage. It is most likely that these artifacts were transported upwards from a more deeply buried deposit by post-depositional processes. VAFB is assuming CA-SBA-1009 is eligible for the NRHP for the purposes of this project only. Given this assumption, the archaeological remains within the uppermost meter of soil would not contribute to the eligibility of the archaeological site. Geotextile fabric and gravel would be placed along the proposed access road and boulder delivery and storage area to afford the site the greatest protection possible. When project construction is completed, the gravel and geotextile fabric would be removed. These measures would avoid impacts to site CA-SBA-1009.

CA-SBA-1011

Project activities near CA-SBA-1011 would include the establishment of a temporary construction access road that runs from Sheridan Road southward across the agricultural field and along the eastern boundary of the site, which then turns west to run down the creek bank into the bottom of the creek. The construction access road limits would be designated using orange mesh temporary fencing, stakes, or some other readily visible marker, as appropriate. Additionally, in the area southeast of the site, there would be a boulder storage and delivery area. When project construction is complete, all temporary work areas would be restored to their original condition to the maximum extent feasible and revegetated. Impacts to CA-SBA-1011 would be completely avoided by erecting orange-mesh temporary fencing around the site prior to construction to keep equipment and personnel out of the site.

CA-SBA-2696

Project activities near CA-SBA-2696 would include the establishment of Lee Road as the construction access route. Lee Road runs north-south across CA-SBA-2696; however, it is a former paved road that is built up above the surrounding agricultural fields. At the north end of this segment of Lee Road, a boulder storage and delivery area would be set up on the east side of Lee Road, just beyond the edge of the northern site boundary of CA-SBA-2696. When project construction is complete, all temporary work areas would be restored to their original condition to the maximum extent feasible and revegetated.

Impacts to CA-SBA-2696 would be completely avoided by keeping equipment out of site boundaries. Equipment travel would be restricted to Lee Road, and orange-mesh temporary fencing would be erected between the north site boundary of CA-SBA-2696 and the boulder storage and delivery area.

CA-SBA-3606

Project activities near CA-SBA-3606 include the establishment of a temporary construction access road that runs from Sheridan Road southward across the agricultural field and west of the site down into the creek bottom. Further west, a boulder storage and delivery area would be established. When project construction is complete, all temporary work areas would be restored to their original condition to the maximum extent feasible and revegetated. Impacts to CA-SBA-3606 would be completely avoided by erecting orange-mesh temporary fencing along the western margin of the site to form a barrier between the construction access route and the site.

CA-SBA-3607

Project activities near the site would include rebuilding the south creek bank with compacted fill material. This process would add more soil cover to CA-SBA-3607, thereby making the existing natural cap even thicker. Impacts to the site would be completely avoided as a result of the type of activities planned in this location. No other avoidance measures are required for this work location.

CA-SBA-3932

Project activities in this area include moving the creek thalweg approximately 30 m (100 ft) northward away from the creek bank below San Antonio Road West, and rebuilding the south creek bank with compacted fill material. A large portion of the floodplain would be excavated on the northern bank of the creek. This portion of the floodplain contains CA-SBA-3932.

The floodplain terrace is a key aspect of the proposed project. Avoidance would negate the project's overall purpose and need because the project would not be able to accomplish the desired restoration objectives. Additionally, there are no prudent and feasible project design modifications that could be adopted that would appreciably save this portion of CA-SBA-3932. The proposed project would have an adverse effect to this resource.

CA-SBA-3933

Project activities proposed in the vicinity of CA-SBA-3933 include construction of a grade control structure and temporary access route that runs from Sheridan Road southwest across the agricultural field to the west of the site. This route turns south and down the creek bank into the bottom of the creek bed. Excavation is not required to achieve a 10H:1V slope as the route descends the creek bank. Additionally, a boulder storage and delivery area would be established at the edge of the creek bank. Although the boulder storage area is near CA-SBA-3933 in the horizontal plane, it is separated vertically by 3.08 m (10.1 ft) of non-cultural soil. Therefore, there would be no impacts to CA-SBA-3933, and no avoidance measures are required for this site.

CA-SBA-3934

Project activities in this area include construction of a grade control structure. Key trenches would be excavated up the creek bank to the 100-year flood level. It is highly unlikely that *in situ* archaeological deposits exist in areas where key trenches would be located. The Proposed Action would not affect CA-SBA-3934.

4.3.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize additional potential adverse effects to Cultural Resources during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- Geotextile fabric would be laid out, and small diameter rock placed on top, to prevent soil compaction within known cultural sites.
- Exclusionary fencing would be erected between known cultural sites and work areas to prohibit vehicular and pedestrian traffic.
- An archaeologist and Native American monitor would be present during project activities located within the creek terrace and banks.
- In the event that previously undocumented cultural resources are discovered during construction activities, procedures established in 36 CFR 800.13 and the VAFB Integrated Cultural Resources Management Plan would be followed.

4.3.3 No-Action Alternative

Under the No-Action Alternative, the proposed creek restoration would not occur, and there would be no adverse effects to cultural resources.

4.4 Earth Resources

Factors considered during evaluation of the environmental consequences of the Proposed Action and the No-Action Alternative on earth resources include seismicity, structural damage, tsunamis, surface fault ruptures, and liquefaction.

4.4.1 Proposed Action

Based on a review of the documentation available relative to the geological characteristics and seismic activity of the region, no impacts on geology and soils are anticipated from the Proposed Action.

Implementation of the Proposed Action would require the removal of vegetation and disturbance of soil during excavation. These activities typically loosen the soil and tend to promote erosion during periods of wind or rainfall. Because soils in the area are subject to high wind erosion, appropriate sediment and soil control techniques would be used to minimize soil loss. Soil erosion would be prevented through the restoration of vegetation types during project implementation. With these measures, impacts should be less than significant. Restoration activities would provide long-term beneficial effects by increasing slope stability and decreasing the potential for erosion of the creek bed and banks.

4.4.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Earth Resources during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- A SWPPP and BMPs would be prepared and implemented to minimize storm water runoff and erosion as part of the NPDES Construction General Permit.

4.4.3 No-Action Alternative

Under the No-Action Alternative, the proposed restoration of San Antonio Creek on VAFB would not occur. Thus, earth resources would not be affected by project activities. No long-term grade control or bank stabilization would occur, which would allow further erosion of the creek bed and banks.

4.5 Hazardous Materials and Waste Management

Potential impacts as a result of hazardous materials and waste are evaluated using federal, state, and local regulatory requirements, contract specifications, and Base operating constraints, as outlined in Chapter 3, Section 3.5. Hazardous materials management requirements are found in federal and state EPA and OSHA regulations, contract specifications and the VAFB *Hazardous Material Management Plan*,

30 SWP 32-7086. Hazardous waste management requirements are found in federal, state, and local regulations, contract specifications and the VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A. Non-compliance with applicable regulatory requirements, human exposure to hazardous materials and wastes, or environmental release above permitted limits, would be considered adverse impacts.

4.5.1 Proposed Action

Compliance with all applicable federal, state and local regulations, rules and requirements, and applicable VAFB plans, would govern all actions associated with implementing the Proposed Action, and would minimize the potential for adverse effects. Hazardous materials and waste management regulations required by federal, state, and local laws and regulations, and procedures outlined in the VAFB *Hazardous Material Management Plan*, 30 SWP 32-7086, and VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A, would be followed. Implementing the Proposed Action would require the use of hazardous materials. As described in Chapter 3, Section 3.5, these hazardous materials would be the same types as currently used and managed on VAFB. Because the Proposed Action would last only 7 to 10 weeks, and a small number of workers would be working at any one time (approximately 30-40 personnel), there would not be a significant increase in the amounts of hazardous materials present on VAFB. Thus no significant adverse impacts are anticipated.

Potential adverse effects could result from accidental releases of POLs from vehicle and equipment leaks. All hazardous wastes would be properly managed and disposed of in accordance with applicable federal, state, and local hazardous waste regulations, and the VAFB *Hazardous Waste Management Plan*, 30 SWP 32-7043A. All hazardous wastes would be managed during release response and clean-up.

4.5.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Hazardous Materials and Waste Management during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

Strict compliance with all applicable federal and state statutes and regulations, as well as local support plans and instructions including 30 SWP 32-7086, *Hazardous Materials Management Plan*, and 30 SWP 32-7043A, *Hazardous Waste Management Plan,* would avert the potential for adverse impacts to the environment as a result of potential generation of hazardous materials and waste during implementation of the Proposed Action.

Implementing the measures presented below should further minimize the potential for adverse impacts from hazardous materials or waste.

- All hazardous materials required to operate and maintain construction equipment would be properly identified and used in accordance with manufacturer's specifications to avoid accidental exposure or release.
- Standard procedures would be used to ensure that all equipment is maintained properly and free of leaks during operation, and all necessary repairs are carried out with proper spill containment. A Spill Prevention Plan would be submitted for 30 CES/CEV approval.
- Hazardous materials would be properly stored and managed in secured areas located outside the riparian corridor.
- Hazardous materials would be procured through or approved for use by the VAFB HazMart. Monthly usage of hazardous materials would be reported to the HazMart to meet legal reporting requirements.

- Chemical stockpile spill containment, if necessary, would be accomplished to minimize or preclude hazardous releases.

- All equipment and holding tanks would be staged, repaired, and maintained at least 500 ft outside the riparian corridor of San Antonio Creek. Fueling and addition of oil/fluids to equipment would be done in pre-designated, controlled surfaces to minimize risks from accidental spillage or release. Spill containment material would be placed around the equipment before fuels, or other hazardous substances such as oil or brake fluid, are brought in.

- Equipment operating from the creek banks would be restricted to temporary access roads whenever possible, and the time it is operated outside of these areas would be minimized to the greatest extent feasible. Equipment operating within the creek bed would be placed on protective mats to prevent contamination of the creek bed.

- If refueling or repair of equipment within the creek bed or riparian corridor is required, safety measures such as the use of temporary catch pans or basins to contain accidental overflow would be implemented. A creek bed refueling spill prevention and containment plan would be prepared and submitted to the 30 CES/CEV for approval.

- If any equipment repairs are necessary within the creek bed or the riparian corridor, repair would not begin without implementation of a spill prevention and containment plan, and the presence of a qualified biological monitor on the project site.

- All excess materials excavated would be removed from the creek bed and transported to a designated waste or fill site.

4.5.3 No-Action Alternative

Under the No-Action Alternative, the restoration of San Antonio Creek on VAFB would not be implemented and, therefore, there would be no change in the management or levels of hazardous materials and waste.

4.6 Human Health and Safety

4.6.1 Proposed Action

Compliance with OSHA regulations, and other recognized standards and applicable Air Force regulations or instructions, would be implemented. A health and safety plan would be developed and a formally trained individual would be appointed to act as safety officer. The appointed individual would be the point of contact on all problems involving job site safety. During performance of work, all provisions and procedures prescribed for the control and safety of personnel and visitors to the job site would be implemented. Therefore, human health and safety would not be adversely impacted by general project-related hazards.

With the implementation of the Environmental Protection and Monitoring Measures outlined in Section 4.6.2, potential health risks to project personnel and the public should be minimal, if any.

Long-term stabilization of the south creek bank would provide a beneficial effect to public safety because it would reduce the potential for San Antonio Road West to be undermined and to fail structurally during heavy flow periods within San Antonio Creek.

Other Potential Hazards

Under the Proposed Action, potential physical hazards typical of any outdoor environment, including holes or ditches, uneven terrain, sharp or protruding objects, slippery soils or mud, and biological hazards including vegetation (i.e. poison oak and stinging nettle), animals (i.e. insects, spiders, and snakes), and disease vectors (i.e. ticks, rodents), exist at and near the proposed restoration areas, and have the potential to adversely impact the health and safety of project personnel. Adherence to federal OSHA regulations should minimize the exposure of workers to these hazards.

Unexploded Ordnance

Special precautions need to be taken in certain areas of VAFB that were used as

practice ranges for artillery firing, referred to as areas of potential UXO. Coordination with the EOD Flight prior to implementing the Proposed Action should ensure no adverse effects on human health and safety occur.

Noise

According to regulations of the federal OSHA, employees should not be subjected to sound exceeding a L_{eq1H} of 90 dB for an 8-hour period. This sound level increases by 5 dB with each halving of time (e.g., 4-hour period at 95 dB). Exposure up to a L_{eq1H} of 115 dB is permitted for a maximum of only 15 minutes during an 8-hour workday and no exposure above 115 dB is permitted. For this analysis, OSHA standards are used as the "not to exceed" criteria as they are the most appropriate standards available.

The Proposed Action would temporarily increase the ambient noise levels within the project area and in neighboring areas during project implementation activities. Relatively continuous noise would be generated by construction equipment. These continuous noise levels are generated from equipment that have source levels (at 1 meter) ranging from approximately 72.7 to 112.7 dB. As a sound source gets further away, the sound level decreases. This is called the attenuation rate. The rates are highly dependent on the terrain over which the sound is passing and the characteristics of the medium in which it is propagating. The rate used in these estimates was a decrease in level of 4.5 dB per doubling of distance. This average rate has been shown to be an accurate estimate from field data on grassy surfaces (Harris 1998). At 50 m these levels range from 47.3 to 87.3 dB. Adverse effects as a result of noise are expected to be minimal and less than significant.

4.6.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Human Health and Safety during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- To provide for the health and safety of workers and visitors who may be exposed to the operations of the Proposed Action, federal OSHA and AFOSH requirements would be implemented during the entire project duration.
- A Health and Safety Plan would be developed and implemented. Additionally, coordination with the EOD Flight would occur prior to implementing the Proposed Action to ensure no adverse effects on human health and safety would occur from unexploded ordnance issues.
- To minimize the potential adverse impacts from biological hazards (e.g., snakes and poison oak) and physical hazards (e.g., rocky and slippery surfaces), awareness training would be incorporated into the worker health and safety protocol.

4.6.3 No-Action Alternative

Under the No-Action Alternative, the proposed habitat restoration would not be implemented and, therefore, there would be no impacts to worker safety. However, the creek banks would continue to erode, decreasing the stability and integrity of San Antonio Road West. This could cause a significant public safety hazard for commuters traveling along San Antonio Road West.

4.7 Land Use and Aesthetics

Factors considered in the evaluation of the environmental consequences of implementing the Proposed Action and No-Action Alternative for land use and aesthetics include:

- Public accessibility to recreational areas in the vicinity of the proposed project.
- The potential for a decrease in available agricultural lands near the project area.

4.7.1 Proposed Action

During project activities temporary access roads and staging areas would be constructed within agricultural fields located throughout the restoration area. When construction is complete, these areas would be returned to their original condition. A temporary decrease in productivity would occur during project implementation; however, the Proposed Action would not result in a long-term conversion of prime agricultural land or cause a decrease in the utilization of land.

Access to recreational areas in the vicinity of the proposed project would not be restricted during the construction period. Throughout the project duration, traffic on San Antonio Road West would be restricted to one lane. However, traffic restrictions are not expected to interfere with public access to facilities on VAFB or recreational areas, and only minor delays are anticipated as a result of roadway restrictions.

A small amount of open space would be used to construct grade control and bank stabilization structures. However, because these areas would be revegetated, there would be no long-term net loss of open space area.

4.7.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Land Use and Aesthetics during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

Because of the potential for temporary adverse downstream effects that may occur during project implementation within the California Coastal Zone, the Air Force will coordinate the Proposed Action with the California Coastal Commission prior to implementation.

4.7.3 No-Action Alternative

Under this alternative, restoration of San Antonio Creek on VAFB would not occur. The integrity of San Antonio Road West could be compromised as stream flows continue to erode the creek banks. Further erosion of the creek banks could result in the closure of San Antonio Road West, prohibiting access to north Base facilities. The loss of San Antonio Road West would have a significant adverse effect to land use on VAFB.

4.8 Transportation

Impacts to the transportation system at VAFB would be considered significant if:

- A primary roadway could no longer service the traffic demands of that roadway;
- The project access to a primary or local road would require a driveway that would create an unsafe situation or a new traffic signal or major revisions to an existing traffic signal; or
- The project adds traffic to a roadway that has limiting design features or receives use that would be incompatible with substantial increases in traffic, which would become potential safety problems with the addition of project or cumulative traffic. Limiting design features include, but are not limited to narrow width, roadside ditches, sharp curves, poor sight distance, and inadequate pavement structure. Some examples of a roadway receiving incompatible use are large number of heavy trucks on rural roads used by farm equipment, livestock, horseback riding, or on residential roads with heavy pedestrian or recreational use.

4.8.1 Proposed Action

Given the low ADT volumes and good LOS currently experienced on the roadways that would be affected by project activities on VAFB, the slight increase in daily truck traffic anticipated under the Proposed Action would not result in adverse effects to their capacity.

All VAFB roadway sections should continue to operate at an LOS in the range of A to B with project-added traffic.

Numerous truck trips on roads and highways in the vicinity of the proposed restoration area would be required to transport large quantities of material to the project site. These activities would be coordinated with Caltrans to ensure authorization of truck travel routes. A traffic control plan would be developed in coordination with the California Highway Patrol (CHP), and implemented to adequately facilitate the movement of traffic, that would cover all conditions to be encountered during construction.

While the current condition of the pavement on all of the affected roadways on VAFB is fair to good, added truck traffic could cause faster than estimated deterioration of the pavement surface and require additional maintenance. Roadways disturbed by construction activities or construction vehicles would be properly restored to ensure long-term protection of the road surface.

No significant impacts are anticipated from the Proposed Action. Implementing the measures described in Section 4.8.2 should minimize the potential for adverse effects on transportation.

4.8.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Transportation during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

- Truck trips would be scheduled during non-peak traffic hours.
- VAFB would coordinate with Caltrans and the CHP for the transportation of rock from quarries to the project site, and for accessing the project site through Hwy 1.
- Warning signs, cones, and flaggers would be provided to warn roadway users of lane closures on San Antonio Road West, of truck crossings on Hwy 1, and to control traffic flow.
- Both lanes of San Antonio Road West would remain open at all times during non-construction periods.
- Construction equipment would not be parked along the shoulder of San Antonio Road West during non-construction periods.
- Project employees would be encouraged to carpool and eat lunch on-site.

4.8.3 No-Action Alternative

Under the No-Action Alternative, no restoration activities would occur. Therefore, there would be no effect on existing transportation. However, the banks of San Antonio Creek would continue to erode, decreasing the stability and integrity of San Antonio Road West. If the road were to collapse, traffic would be forcibly diverted to other roads, and result in an interruption of mission essential transportation. In addition, such a situation would result in a fast track reconstruction project involving intensive construction activities. Such an action could affect local traffic conditions and cause adverse effects on local transportation routes.

4.9 Water Resources

Adverse impacts to water resources would occur if the Proposed Action:

- Caused substantial flooding or erosion;
- Adversely affected surface water quality to creeks or rivers; or
- Adversely affected groundwater or water quality to localized water resources.

4.9.1 Proposed Action

The Proposed Action would require coverage under the NPDES Construction General Permit because the total disturbed area would be greater than 1 acre. A SWPPP would be

developed and implemented to maintain compliance with the NPDES Construction General Permit. During site preparation and construction activities, storm water/erosion BMPs would be implemented during and after any clearing, excavation, and grading. Long-term BMPs would be put in place to address storm water erosion after project completion.

A *Notice of Intent* would be submitted to the SWRCB. A *Notice of Termination* would be submitted to the Central Coast RWQCB to ensure all permit termination requirements are met. The *Notice of Intent* and *Notice of Termination* would be coordinated with the 30 CES/CEV and signed by the 30th Civil Engineer Squadron Commander (30 CES/CC) or Deputy Commander (30 CES/CD) prior to submittal.

A CWA Section 401 Water Quality Certification from the Central Coast RWQCB and CWA Section 404 Permit from the USACE would also be required under the Proposed Action because direct impacts to water bodies or wetlands would occur.

All permit conditions would be implemented, including SWPPP BMPs and inspections, and the VAFB *Discharge to Grade Program* to minimize the potential for adverse impacts to local water resources. With the implementation of these procedures and requirements, adverse effects to water resources would be less than significant, as described below.

4.9.1.1 Surface Water

Construction activities would include the use of hazardous materials that could result in an adverse impact if not properly controlled and managed. The use of POLs during construction poses the potential for releasing pollutants and adversely affecting water resources. Proper management of materials and wastes during construction would reduce or eliminate the potential for contaminated runoff. There would be no discharge of groundwater to surface water. The VAFB *Discharge to Grade Program* would manage wastewater discharges that may occur during project activities, including accumulated storm water. As required by the NPDES Construction General Permit, BMPs would be implemented to properly manage materials, and reduce or eliminate project-associated runoff to further reduce the potential for adverse effects, especially during the rainy season.

Because equipment may require refueling within the creek bed, a creek bed refueling plan would be included in the Spill Prevention and Containment Plan, including appropriate safety precautions and personnel training. At a minimum, the plan should include measures that would prevent the contamination of the substrate in the event of an accidental spill and an emergency clean-up plan in the event of an accidental spill.

The containment of the active channels in culverts within the construction zone should minimize the exposure of the stream water to any project-related contaminants.

With these measures in place, adverse effects to surface water should be less than significant. Potential project-related effects to sediment are addressed in Section 4.9.1.2 below.

4.9.1.2 Sediment

The Proposed Action may result in an increase in sediment load during project implementation due to excavation of the creek bed and banks, placement of fill material, and removal of vegetation. Increases in sediment load in the vicinity of the proposed project area would be minimized by containing the active river channels within temporary culverts, and by implementing erosion and sediment control BMPs (i.e., silt fencing), and measures described in the project's SWPPP. In the event construction activities continue beyond October 15, disturbed soil areas would be stabilized at least 48-hours in advance of a predicted rain event. After construction, any disturbed/bare ground areas, except established roads and the active creek channel, would be revegetated with an appropriate plant and seed mix. Restoration of vegetation types during project implementation should minimize potential

sediment loading post-construction through soil stabilization. In addition, all NPDES Construction General Permit requirements would be implemented until the Central Coast RWQCB officially terminates the permit coverage. No significant adverse impacts would occur from the Proposed Action. The measures detailed in Section 4.9.2 should minimize or prevent the potential for adverse effects.

The existing creek channel restricts stream flows, which increases sediment deposition over a small area. Excavation of floodplain terraces within the proposed restoration area would allow stream waters to flow over larger areas, and sediment would accumulate less rapidly. Sediment loads are expected to decrease within the section of San Antonio Creek proposed for restoration as the area of deposition increases.

A portion of the sediment delivered to the San Antonio Creek riparian corridor comes from continued erosion of the channel bed and banks. The installation of grade control and bank stabilization structures would decrease the rate of erosion of the creek bed and banks, resulting in a reduction in the sediment load of the creek through the restoration area.

4.9.1.3 Floodplain

The proposed restoration area is located within the San Antonio Creek floodplain. Creek restoration activities would necessitate working within this floodplain. Chapter 2 of this EA supports the finding that there is no practicable alternative to construction within the floodplain or wetland areas. The floodplain limits in the vicinity of restoration area would not be altered by activities associated with the Proposed Action. The 100-year floodplain limit and duration of flooding within the project area would remain approximately the same as those currently present.

4.9.1.4 Hydraulics

The active river channel would be temporarily contained in culverts, allowing for unimpeded flow through the restoration area. This would allow the creek to maintain its seasonal hydraulic capacity and minimize the potential for adverse impacts to water resources during project implementation.

Construction of rock-riffle grade controls, low-flow channels, and floodplain terraces would alter the velocity, width, and depth of San Antonio Creek through the restoration area. The Proposed Action would provide a beneficial effect of increasing flow areas and decreasing velocity. In addition, enhanced hydraulic conditions for the dense willow riparian woodland habitat are anticipated.

4.9.1.5 Groundwater

Groundwater is likely to be encountered during excavation within the creek bed. If dewatering is necessary, approval would be obtained from the 30 CES/CEV Water Resources Program Manager. The water would be filtered and discharged into a vegetated area outside the creekbed and downstream of the project area. Grade control structures would prevent headcuts present in the creek bottom from migrating upstream, reducing potential lowering of the groundwater table through the restoration area.

No significant impacts would occur from the Proposed Action. The measures detailed in Section 4.9.2 should minimize or prevent the potential for adverse effects to groundwater.

4.9.2 Environmental Protection and Monitoring Measures

Implementation of the environmental protection and monitoring measures outlined below should avoid or minimize potential adverse effects to Water Resources during implementation of the Proposed Action. These measures are considered integral elements of the project description, and would be fully implemented.

Compliance with NPDES Construction General Permit and CWA Section 401 Water Quality Certification conditions should minimize potential adverse impacts to water resources. A SWPPP approved by

30 CES/CEV would be developed and implemented prior to initiation of any activities under the Proposed Action. *Discharge to Grade Program* procedures should minimize the potential for adverse impacts to local water resources.

In addition, implementation of the measures described below should further reduce the potential for adverse effects to water resources:

- Construction activities within the creek would occur between approximately August 25 and October 15. In the event construction activities continue beyond October 15, disturbed soil areas would be stabilized, and construction vehicles and potential pollutants removed from the project area 48-hours in advance of a predicted rain event.
- A Certified Erosion and Sediment Control Specialist, or other qualified professional experienced in erosion and sediment control, would be onsite during construction activities.
- BMPs, including erosion and sediment control, proper spill prevention practices for all stored liquids and construction vehicles, and permanent erosion control, would be implemented to prevent sediment or chemicals from entering creek and storm waters.
- Temporary creek diversions would be constructed of materials free of pollutants such as soil, silt, sand, clay, grease or oil. Diversions would be adequately designed to accommodate fluctuations in water flow volume, and would provide for velocity dissipation at the outfall.
- Approval would be obtained from the 30 CES/CEV Compliance Office, Water Resources Manager, prior to any release to grade of any water (*Discharge to Grade Program*).
- If dewatering is necessary, the water would be discharged to an upland vegetated location downstream of the project area in a manner that would not cause erosion. Water pumps used to dewater excavated areas would incorporate filters.
- Appropriate sediment control (e.g., fiber rolls, silt fencing) would be erected in all needed areas to prevent sediment loading.
- All disturbed areas resulting from construction, except established roads and the active creek channel, would be revegetated during implementation of the Proposed Action.
- During construction activities, areas with exposed disturbed soil would be stabilized per the NPDES Construction General Permit (refer to Section A, item 7, page 15 of the Permit).
- Acceptable water quality parameters (e.g., pH, temperature, DO, turbidity), determined by the Central Coast RWQCB Basin Plan, would be monitored during the construction period no more than 400 ft downstream of the project area.

4.9.3 No-Action Alternative

Under the No-Action Alternative, the proposed creek restoration would not occur and, no impacts to water resources would occur as a result of project activities. However, further incision of the creek bed and banks during periods of high stream flows would occur, increasing the sediment load and turbidity of the creek. The headcuts present in the creek channel would continue to migrate upstream, resulting in the lowering of the groundwater table.

4.10 Cumulative Impacts

Adverse cumulative impacts (hereinafter referred to as “cumulative impacts”) result from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of the agency that undertakes these other actions. Cumulative impacts can result from actions whose adverse impacts are individually minor or negligible, yet, over a period of time, are collectively significant.

Emergency repairs to three sites within San Antonio Creek and a tributary were performed

in late February and early March of 1998 to protect threatened facilities. Additional long-term erosion repairs are proposed at the Bank Stabilization Site 2 and Lee Road Utility Bridge Site. The combination of these actions would result in greater impacts than would have occurred with a single action within this section of San Antonio Creek. However, it is anticipated that the net effects of these actions would be beneficial, given the biological creek restoration that would be implemented as part of the Proposed Action.

A partial list of projects for which NEPA analysis was completed within the past 5 years, including cumulative impacts analysis, is detailed in Table 4-2. Of these, projects that are currently in progress or will be implemented in the future at VAFB include: demolition and abandonment of Atlas and Titan facilities, installation of fiber optic lines associated with the VTRS Supplement, emergency repair of the 13th Street Bridge, and several projects to occur within the main and south Base cantonments under the Military Construction (MILCON) and non-appropriated funds programs. Future projects for which NEPA analysis is currently underway include: western snowy plover habitat restoration, safety and security upgrades of entry control facilities, and Western Range instrumentation modernization.

Air quality impacts were considered in conjunction with on-going and future projects planned at VAFB. The cumulative emissionsfrom projects included under the Proposed Action and past, present, and future projects would not exceed the significance thresholds of 548 lbs/day or 100 tons/year because any project that would cause an exceedance would be postponed until the following calendar year. Therefore, no significant cumulative impacts to the region's air quality would occur.

Adverse effects to biological and cultural resources should be minimized with the implementation of measures described in Sections 4.2.2 and 4.3.2 of this EA, identified in EAs completed for other projects, to be incorporated in EAs currently under development for future projects, and identified and established by VAFB for operations and maintenance (O&M) projects. With these measures in place, no significant cumulative impacts are anticipated.

No significant impacts to earth resources are anticipated from either the Proposed Action or any of the other projects currently being implemented on VAFB. Environmental

Table 4-2. Partial list of projects for which NEPA analysis has been completed in the previous 5 years.

Name of Project	NEPA Analysis Timeframe	Project Timeframe
13th Street Bridge Emergency Repairs	EA completed in 2003.	Project completed in 2004.
VTRS Fiber Optic Cable Installation	EA completed in 2004.	Project mostly completed in 2007. See VTRS Supplement below.
Demolition and Abandonment of Atlas and Titan Facilities	EA completed in 2005.	Project on-going.
Combat Information Transport System Upgrade	EA completed in 2006.	Project completed in 2007.
VTRS Supplement	EA completed in 2007.	Project to be implemented in Spring 2008.
New 13th Street Bridge	EA completed in 2007.	Project implementation in flux, currently no earlier than 2011.
2007 General Plan for Main and South Base Cantonments	EA completed in 2008.	Projects to be implemented between 2009 and 2014.

assessments under development for future projects would identify any potential adverse effects to earth resources and describe measures to avoid or minimize these adverse effects. No cumulative impacts are anticipated.

When considered with other past, present, and future projects on VAFB, the Proposed Action was found to have no cumulative impacts on Environmental Justice, as activities covered under this EA would occur within VAFB boundaries and not affect minority communities.

Hazardous materials/wastes encountered or generated during the Proposed Action would be managed in strict compliance with all applicable statutes and regulations, as well as local support plans and instructions including 30 SWP 32-7086, *Hazardous Materials Management Plan*, and the 30 SWP 32-7043A, *Hazardous Waste Management Plan*, to avert the potential for adverse impacts.

Implementing the measures described in Section 4.5.2 of this EA, identified in the EAs completed for other projects, to be incorporated in EAs currently under development for future projects, and identified and established by VAFB for O&M projects, should avoid or minimize any potential adverse effects. No significant cumulative impacts are anticipated.

Given the requirement to comply with federal and state OSHA, and all other applicable federal, state, and local regulations, no adverse impacts and therefore no cumulative impacts to Human Health and Safety are anticipated.

No cumulative impacts are anticipated in regards to land use as the Proposed Action, would not change land use on VAFB, result in the conversion of prime agricultural land to other uses, or result in adverse effects.

No adverse impacts to socioeconomics and therefore no cumulative impacts are expected under the Proposed Action, given that small numbers of personnel utilized for creek restoration activities and the short-term nature of the activities.

Minimal levels of solid waste are anticipated to occur under the implementation of the Proposed Action. All solid waste would be properly disposed of, at either at the VAFB Landfill or off VAFB property, as appropriate. With these measures in place no significant cumulative effects are anticipated.

Given the good LOS ratings for primary roadways at VAFB, and with the implementation of measures described in Section 4.8.2 of this EA, identified in the EAs completed for other projects, to be incorporated in EAs currently under development for future projects, and identified and established by VAFB for O&M projects, activities covered under the Proposed Action would be unlikely to have significant impacts to the transportation system on VAFB and in the region. No cumulative impacts are anticipated.

All activities under the Proposed Action would be subject to all requirements contained in the NPDES Construction General Permit. Implementation of measures described in Section 4.9.2 of this EA, identified in the EAs completed for other projects, to be incorporated in EAs currently under development for future projects, and identified and established by VAFB for O&M projects, should avoid or minimize any potential adverse effects. No significant cumulative impacts to water resources are anticipated.

To ensure that no significant cumulative impacts result from VAFB projects occurring concurrently or non-currently, VAFB includes environmental contract specifications and mitigation/protective measures as necessary in all projects. Actions are taken during the planning process to ensure adverse impacts are minimized or avoided all together as projects are reviewed under NEPA. Prior projects are also considered to ensure no levels of acceptable impacts are exceeded.

With these practices in place, and given that all VAFB projects are designed and implemented to be in full compliance with

applicable statutes and regulations, and environmental protection measures are developed in coordination with appropriate regulatory agencies, the activities included under the Proposed Action, in conjunction with other foreseeable projects at VAFB, would not result in significant cumulative impacts.

Chapter 5. Persons and Agencies Contacted

Tim Belton, Rangeland Ecologist, 30 CES/CEV, VAFB

Mike Bird, Project Manager, 30 CES/CECC, VAFB

Tom Cugini, Chief, Civil Engineering and Contracts, 30 CES/CECC, VAFB

Dave Derrick, Research Hydraulic Engineer, USACE Waterways Experiment Station

Brian Doeing, Senior Associate Engineer, HDR Inc.

Rhys Evans, Wildlife Biologist, 30 CES/CEV, VAFB

Jordan Hampton, Transportation Engineer, 30 CES/CECC, VAFB

Nic Huber, U.S. Fish and Wildlife Service, Ventura Field Office

Bea Kephart, Chief, Environmental Flight, 30 CES/CEV, VAFB

Luanne Lum, Botanist, 30 CES/CEV, VAFB

John McCullah, Watershed Geologist, Salix Applied Earthcare

Lynne Neuman, HQ AFSPC/A4/7PP, Peterson Air Force Base

Roger Root, U.S. Fish and Wildlife Service, Ventura Field Office

Chris Ryan, Chief, Cultural Resources, 30 CES/CEV, VAFB

Dina Ryan, Environmental Planner, 30 CES/CEV, VAFB

Santa Ynez Band of Chumash Indians

Milford Donaldson, State Historic Preservation Officer, Office of Historic Preservation, California State Parks

Dave Savinsky, Air Quality, 30 CES/CEV, VAFB

Jamie Uyehara, Wildlife Biologist, 30 CES/CEV, VAFB

Tara Wiskowski, Water Quality, 30 CES/CEV, VAFB

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Chapter 6. List of Preparers

Abela, Alice, Wildlife Biologist, ManTech SRS Technologies, Inc.
B.S. 2003 Biology, California Polytechnic State University, San Luis Obispo
Years of Experience: 5

Ball, Morgan, Wildlife Biologist, ManTech SRS Technologies, Inc.
B.S. 2001 Biology, Evolution/Ecology, University of California, Santa Barbara
Years of Experience: 10

Lebow, Clayton, Vice President/Senior Archaeologist, Applied EarthWorks, Inc.
B.S. 1977, Forest Engineering, Oregon State University, Corvallis
M.A. 1982, Archaeology, Cultural Anthropology & Geography, Oregon State University, Corvallis
Years of Experience: 29

Fillmore, Leslie. Environmental Engineer, ManTech SRS Technologies, Inc.
B.S. 1994. Biology, University of North Carolina at Chapel Hill
Years of Experience: 12

Kaisersatt, Samantha, Biologist, ManTech SRS Technologies, Inc.
B.S. 2000 Ecology & Systematic Biology, California Polytechnic State University, San Luis Obispo
Years of Experience: 8

Nieto, M. Paloma, Conservation Program Manager/Senior Research Biologist, ManTech SRS Technologies, Inc.
B.S. 1997 Ecology & Wildlife Biology, California Polytechnic State University, San Luis Obispo
M.S. 1999 Biological Sciences, California Polytechnic State University, San Luis Obispo
Years of Experience: 13

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Chapter 7. Distribution List

California Coastal Commission, Federal Consistency Review, San Francisco, CA
California Native Plant Society, Los Osos, CA
California Regional Water Quality Control Board, Central Coast Region, San Luis Obispo, CA
Environmental Defense Center, Santa Barbara, CA
La Purisima Audubon Society, Lompoc, CA
Lompoc Public Library, Lompoc, CA
Natural Resources Conservation Service, Santa Maria, CA
Santa Barbara County Air Pollution Control District, Project Review, Santa Barbara, CA
Santa Barbara Museum of Natural History, Santa Barbara, CA
Santa Ynez Band of Chumash Indians, Tribal Elders Council, Santa Ynez, CA
Santa Barbara Public Library, Santa Barbara, CA
Santa Maria Public Library, Santa Maria, CA
University of California, Library, Santa Barbara, CA
University of California, Museum of Systematics & Ecology, Santa Barbara, CA
U.S. Fish and Wildlife Service, Ventura Field Office, Ventura, CA
VAFB Library, VAFB, CA

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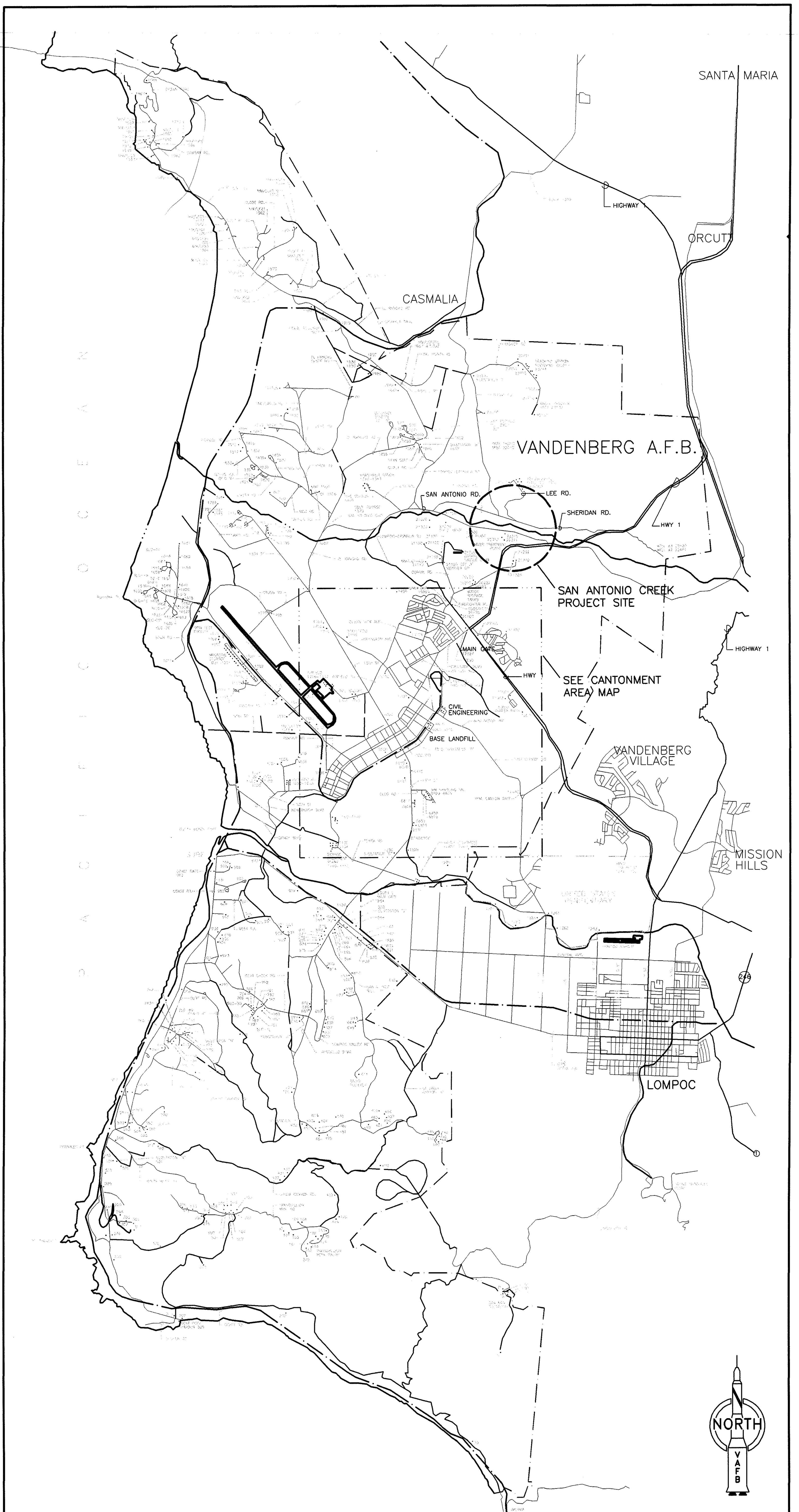
APPENDIX A

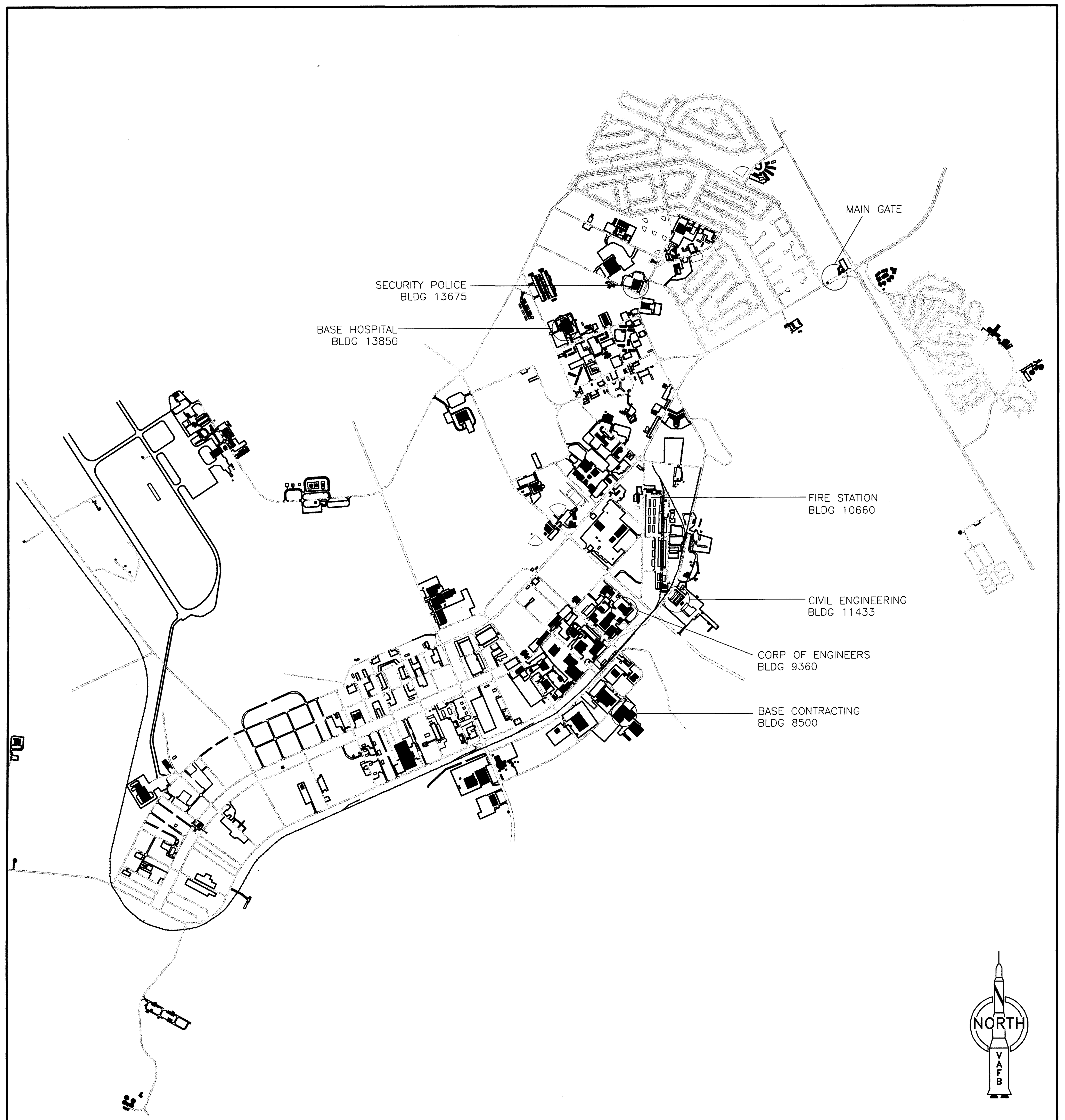
Engineering Plan Views and Typical Details

SAN ANTONIO CREEK
STREAM RESTORATION
100% DESIGN DRAWINGS

XUMU 09-1128B2
30 CIVIL ENGINEER SQUADRON
VANDENBERG AIR FORCE BASE
CALIFORNIA



VICINITY MAP
SCALE: 1:75,000



CANTONMENT AREA MAP
SCALE: 1 IN = 1,500 FT

DRAWING INDEX

DRAWING #	SHEET TITLE
G001	TITLE SHEET
G002	GENERAL CONSTRUCTION NOTES
C401	GENERAL PLAN AND PROFILE
C402	GENERAL PLAN AND PROFILE
C101	SITE 1 – IMPROVEMENT PLAN
C102	SITE 2 – IMPROVEMENT PLAN
C103	SITE 3 – IMPROVEMENT PLAN
C501	TYPICAL DETAILS
C502	TYPICAL DETAILS

100% SUBMITTAL
ISSUED FOR CONSTRUCTION

U.S. AIR FORCE
SPACE COMMAND
VANDENBERG AFB

DRAWN JSR
DESIGNED JSR/SRD
REVIEWED BJD

PROJECT TITLE SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE TITLE SHEET
DATE 02/22/08
SCALE AS NOTED

PROJECT # 09-1128B2
DRAWING # G001
1 OF 9
SHEET #

PLANTINGS

1 ALL DSAs WILL RECEIVE THE STANDARD TREATMENT WHICH INCLUDES:
   A. SOIL PREPARATIONS [SURFACE ROUGHENING AND TRACK WALKING (SHEET 9 DETAIL C)].
   B. SOIL AMENDMENTS [AM 120 MYCORRHIZAE INOCULUM OR EQUIVALENT 60 LB/AC, BOISOL MIX 7–2–3 FERTILIZER 800 LB/AC, AND 2–IN COMPOST (IF REQUIRED, AS DIRECTED BY ONSITE ENGINEER)].
   C. SEED MIX (AS NOTED) AND STRAW MULCH 4000 LB/AC. PLANT CREEKSIDE AREAS (BETWEEN 3 FT AND 8 FT ABOVE CHANNEL BOTTOM) WITH SEED MIX A, PLANT UPLAND AREAS (ABOVE 8–FT FROM CHANNEL BOTTOM) WITH SEED MIX B AS DIRECTED BY ONSITE ENGINEER.
2. ALL ACCESS (HAUL) ROADS AND STAGING AREAS SHALL BE PLANTED IN DISTURBED HABITAT (NON–AGRICULTURAL FIELD) AREAS ONLY.
3. ALL ACCESS (HAUL) ROADS AND STAGING AREAS SHALL ADDITIONALLY RECEIVE WILLOW PLANTINGS AT APPROXIMATELY 1 PER 80 SF OF AREA (PLANTED AREA ONLY). INSTALL PER DIRECTION OF ONSITE ENGINEER.
4. SALVAGE AND STORE JUNCUS AND CAREX DIVISIONS FROM SITE OR BARKA SLOUGH AS DIRECTED BY ONSITE ENGINEER. PLANT WITHIN DSA–2YR AREAS AND AS DIRECTED BY ONSITE ENGINEER.
5. CHANNEL BOTTOM AREAS SHALL NOT RECEIVE SEED AS DIRECTED BY ONSITE ENGINEER.

PLANTING SCHEDULE FOR DSAs

DSA	APPROXIMATE AREA (AC)	TREATMENT
CONTRUCTION ACCESS ROADS/STAGING AREAS	4.3*	STANDARD TREATMENT AND WILLOW POLES (1 PER 80 SF)
DSA1-SF (SITE 1)	1.4	STANDARD
DSA2-NC (SITE 1)	0.6	STANDARD
DSA3-SF (SITE 2)	0.4	STANDARD
DSA4-NC (SITE 2)	0.1	STANDARD
DSA5-NC (SITE 3)	0.1	STANDARD
C/7-N (SITE 3)	0.2	STANDARD
C/7-S (SITE 3)	0.1	STANDARD TREATMENT AND WILLOWS IN SELECTED VOIDS
DSA-5YR	0.3	STANDARD
DSA-2YR	0.6	STANDARD AND JUNCUS/CAREX DIVISIONS
OTHER DSAs CAUSED BY CONSTRUCTION	VARIES	PLANT PER PLANTING NOTES 1-5 ABOVE

* ACCESS ROADS/STAGING AREA REPORTED ONLY INCLUDES DISTURBED HABITAT (NON–AGRICULTURAL, AND NOT PREVIOUSLY DISTURBED AREAS).

SEED MIX A (CREEKSIDE)

BOTANIC NAME	COMMON NAME	APPLICATION (LB/AC)
ARTEMESIA DOUGLASIANA	MUGWORT	2
BACCHARIS SALICIFOLIA	MULEFAT	2
CYPERUS ERAGROSTIS	UMBRELLA SEDGE	1
HORDEUM BRACHYANTHERUM	MEADOW BARLEY	8
LEYMUS TRITICOIDES	CREEPING WILD RYE	10
VULPIA MICROSTACHYS	SMALL FESCUE	6
TOTAL		29

SEED MIX B (UPLAND)

BOTANIC NAME	COMMON NAME	APPLICATION (LB/AC)
BACCHARIS PILULARIS	COYOTE BUSH	3
BROMUS CARINATUS	CALIFORNIA BROME	6
ESCHSCHOLZIA CALIFORNICA	CALIFORNIA POPPY	1
HETEROMELES ARBUTIFOLIA	TOYON	2
LASTHENIA GLABRATA	GOLDFIELDS	1
LEYMUS CONDENSATUS	GIANT WILD RYE	3
LIPUNUS BICOLOR	DOVE LUPINE	3
MIMULUS AURANTIACUS LOMPOCENSIS	LOMPO MONKEY FLOWER	3
NASSELLA PULCHRA	PURPLE NEEDLEGRASS	6
PHACELIA RAMOSISSIMA	BRANCHING PHACELIA	2
SAMBUCUS MEXICANA	ELDERBERRY	1
VERBENA LASIOSTACHYS	WESTERN VERNAIN	2
TOTAL		33

GENERAL CONSTRUCTION NOTES

1. SEE DETAIL SHEETS FOR GRADE CONTROL DIMENSIONS AND ELEVATIONS.
2. FOLLOW VEGETATION PLAN AS SHOWN ON PLANS AND NOTED IN SPECIFICATIONS. GENERAL EROSION CONTROLS SHALL BE IMPLEMENTED IN ALL DISTURBED SOIL AREAS IN ADDITION TO PLANTINGS NOTED TO THE LEFT.
3. WATER SHALL BE SPRAYED TO ROADS AND OTHER CONSTRUCTION AREAS TO PREVENT DUST AS NEEDED.
4. CONTRACTOR SHALL NOT ALLOW ANY FILL MATERIAL, ROCK RIP RAP OR OTHER SUBSTANCES TO BE DISCHARGED INTO SAN ANTONIO CREEK.
5. CARE SHALL BE TAKEN TO PRESERVE ALL LIVE LARGE TREES OR SHRUBS THAT MAY BE ENCOUNTERED DURING CONSTRUCTION. LARGE LIVE TREES OR ROOT BALLS SHALL BE PROTECTED TO THE EXTENT POSSIBLE BY CAREFULLY PLACING FILL UNDER EXPOSED AREAS TO PROMOTE STABILITY AND IMPROVE THE TREES LONG–TERM HEALTH AND SURVIVAL. UPROOTED TREES NEED NOT BE PRESERVED AS DESCRIBED ABOVE.
6. CONTRACTOR SHALL NOT USE AREAS BEYOND TEMPORARY WORK LIMITS.
7. MATERIALS FROM EXISTING STREAM MAY BE RELOCATED ON SITE PER THE ONSITE ENGINEER.
8. GRADING LIMITS IN OVERBANK AREAS IN BETWEEN GRADE CONTROL STRUCTURES ARE BASED ON AREAS REQUIRED TO BALANCE CUT AND FILL VOLUMES. THESE MAY BE FIELD ADJUSTED AS NECESSARY WITH VAFB AND ONSITE ENGINEER APPROVAL.
9. ALL DIMENSIONS ARE FEET UNLESS OTHERWISE NOTED.
10. SITE 1 CONTAINS G/C 6 AND 7. SITE 2 CONTAINS G/C 3, 4, AND 5. SITE 3 CONTAINS G/C 1 AND 2.
11. THE VADOSE ZONE, CAPILLARY FRINGE, AND SEASONAL SATURATION ZONE ARE SHOWN FOR INFORMATIONAL PRURPOSES AND WILL BE LOCATED BY THE ONSITE ENGINEER.
12. ONSITE ENGINEER SHALL BE DESIGNATED BY VAFB AND MAY MAKE MINOR FIELD MODIFICATIONS TO THESE DESIGN PLANS. MAJOR DESIGN MODIFICATIONS SHALL REQUIRE APPROVAL OF THE ENGINEER OF RECORD.

SURVEY NOTES

1. HORIZONATAL DATUM USED IN THESE PLANS IS CALIFORNIA COORDINATE SYSTEM NAD 1983 ZONE V HPGN (FEET), VERTICAL DATUM IS NAVD 1988 (FEET). GRID POINTS SHOWN ARE SPACED AT 200 FT.
2. EXISTING TOPOGRAPHIC SURVEY SHOWN ON THESE PLANS IS BASED ON DATA FROM 2005 LIDAR MAPPING PROVIDED BY VAFB. FIELD SURVEYS TO VERIFY THIS DATA WERE PERFORMED IN AUGUST 2006 BY ANDREGG GEOMATICS. AN ADDITIONAL THALWEG SURVEY WAS PERFORMED BY ANDREGG IN MAY 2007. THE MAY 2007 SURVEY PROFILE IS PRESENTED ON SHEETS C1401 AND C1402 IN THESE DRAWINGS. HOWEVER, DIFFERENCES DO EXIST BETWEEN THE PLAN VIEW TOPOGRAPHY AND THE PROFILE SURVEY ELEVATIONS.
3. UTILITY INFORMATION INFORMATION SHOWN ON THESE DRAWINGS IS APPROXIMATE, NOT COMPREHENSIVE AND IS INCLUDED FOR REFERENCE ONLY. OFFICIAL DETERMINATION OF UTILITY LOCATIONS IN WORK AREAS SHOULD BE PERFORMED BY CONTRACTOR PRIOR TO WORK BY OBTAINING A PERMIT FROM VAFB AF FORM 103.
4. EXISTING TOPOGRAPHIC CONTOUR INTERVAL IS 2 FT. PROPOSED FILL SLOPES AND CUT/FILL AREA CONTOUR INTERVALS ARE 2 FT.
5. CONSTRUCTION STAKING POINTS NOTED BELOW ARE APPROXIMATE AND MAY NEED TO BE FIELD MODIFIED PER ONSITE ENGINEER.

CONSTRUCTION STAKING POINTS

POINT	N	E	FINAL GRADE ELEV
A	2114417.42	5812470.20	185.00
B	2114283.98	5812267.83	183.70
C	2114351.53	5812063.49	183.40
D	2114346.01	5811755.14	181.60
E	2114689.63	5810242.78	166.30
F	2114628.68	5810129.72	164.00
G	2114747.56	5809973.11	164.00
H	2115345.19	5809192.90	159.60
I	2115397.75	5809099.81	159.10

EARTHWORK

APPROXIMATE EARTHWORK VOLUMES

	CUT (CY)	FILL (CY)
SITE 1	40,100	43,600
SITE 2	8,600	5,700
SITE 3	2,900	600
TOTAL	51,600	46,000

1. CUT AND FILL VOLUMES ARE REPORTED IN–PLACE. NO ALLOWANCE IS MADE FOR SHRINKAGE OR SWELL.
2. SITE EARTHWORK VOLUMES INCLUDE VOLUMES FOR GRADE CONTROL STRUCTURES PER NOTE 10 ABOVE.

LEGEND

- ROCK RIPRAP
- GRANULAR FILTER OR GRANULAR BEDDING
- PLANTING AREA
- FILL
- EXISTING SOIL
- VEGETATED MECHANICALLY STABILIZED EARTH
- EXISTING CONCRETE RUBBLE
- GEOTEXTILE COVERED WITH STONE (TEMPORARY ACCESS AREA PROTECTION)
- WILLOW POLE PLANTING
- FILL SLOPE
- CUT SLOPE
- WATER SURFACE ELEVATION
- (X) SEE CONSTRUCTION STAKING POINT X ON SHEET 2
- GT("X") IDENTIFICATION AND APPROXIMATE LOCATION OF GEOTECHNICAL TESTING. SEE FUGRO (2008) FOR RESULTS.
- SURVEY BENCHMARK
- GRID MARK (200 FT CCS NAD 83 ZONE V)
- CREATE ACCESS (HAUL) ROAD AND/OR STAGING AREA AS SHOWN (SUBJECT TO FIELD DIRECTION, MINIMAL AMOUNT NEEDED, ENVIRONMENTAL AND CULTURAL RESOURCE CONSTRAINTS, AND MOST SUITABLE SITE CONDITIONS). FOR ACCESS THROUGH VEGETATED AREAS CLEAR A 15 FT WIDE BY 15 FT HIGH CORRIDOR AS DIRECTED BY ONSITE ENGINEER.
- A/X PLAN, DETAIL, OR SECTION CALLOUT SEE A ON SHEET X. "_" REFERS TO SAME SHEET.

ABBREVIATIONS

AHW	APPROXIMATE HIGH WATER ELEVATION
ALW	APPROXIMATE LOW WATER ELEVATION
CCS	CALIFORNIA COORDINATE SYSTEM
CL	CENTERLINE
CM	CENTIMETER
CMP	CORRUGATED METAL PIPE
COM	COMMUNICATIONS LINE
CP	CONTROL POINT
CPESC	CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL
DIAM	DIAMETER
DSA	DISTURBED SOIL AREA
EL, ELEV	ELEVATION
EXIST	EXISTING
FOL	FIBER OPTIC LINE
FT	FOOT/FEET
G/C	ROCK RIFFLE GRADE CONTROL STRUCTURE
GA	GUY ANCHOR
GP	GUY POLE
GT	GEOTECHNICAL TESTING
HORIZ	HORIZONTAL
IN	INCH/INCHES
LPST	LONGTUDINAL PEAK STONE TOE
MAX	MAXIMUM
MIN	MINIMUM
NTS	NOT TO SCALE
OHP	OVERHEAD POWER LINE
PP	POWER POLE
SF	SQUARE FEET
STA	STATION
T/S	TREE AND SHRUB
TYP	TYPICAL
VERT	VERTICAL
WL	WATER LINE
WSEL	WATER SURFACE ELEVATION

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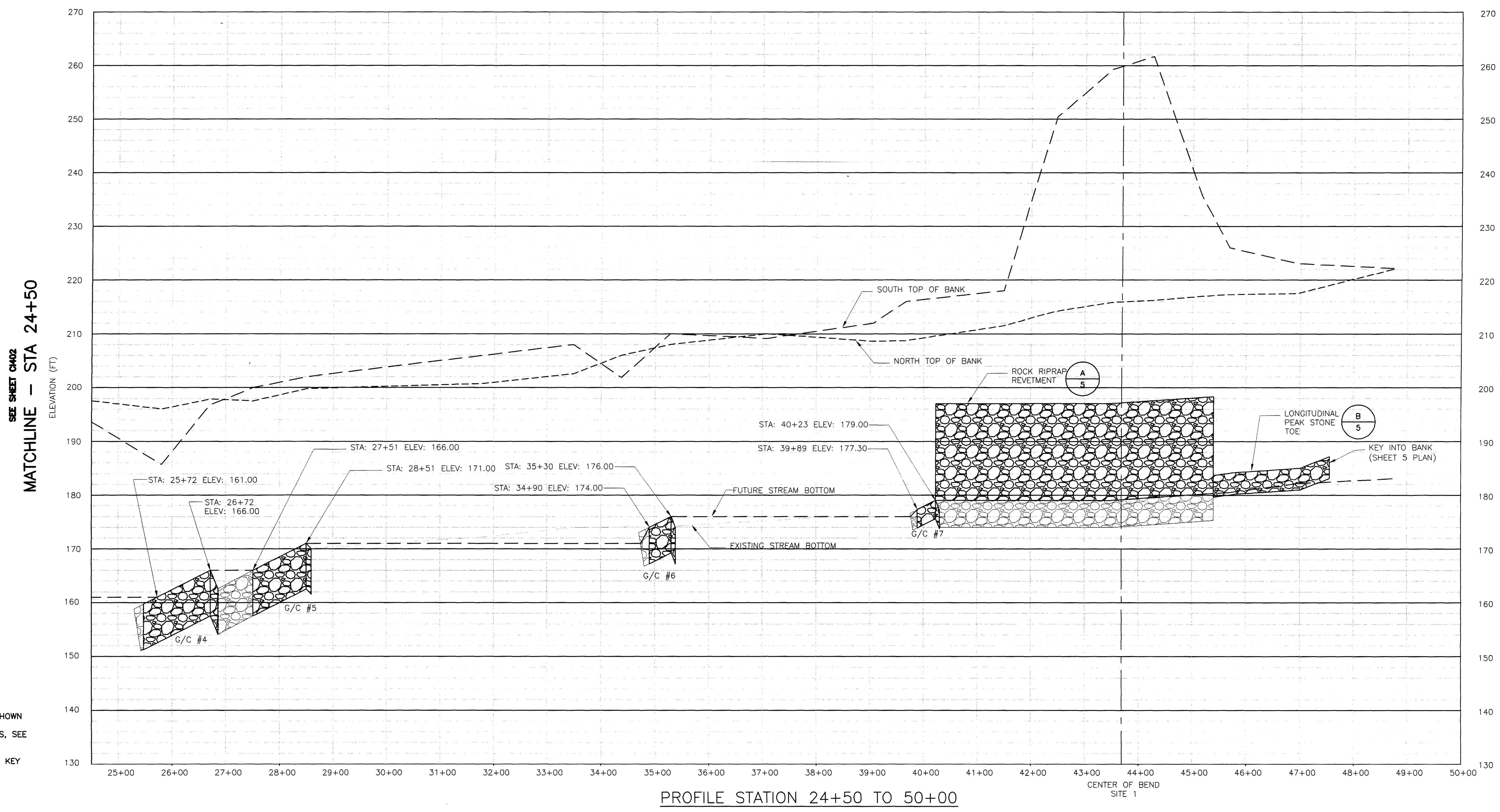
SPACE COMMAND
VANDENBERG AFB

DRAWN JSR | DESIGNED JSR/SRD | REVIEWED BJD

PROJECT TITLE: SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE: GENERAL CONSTRUCTION NOTES
SCALE: AS NOTED
DATE: 02/22/08

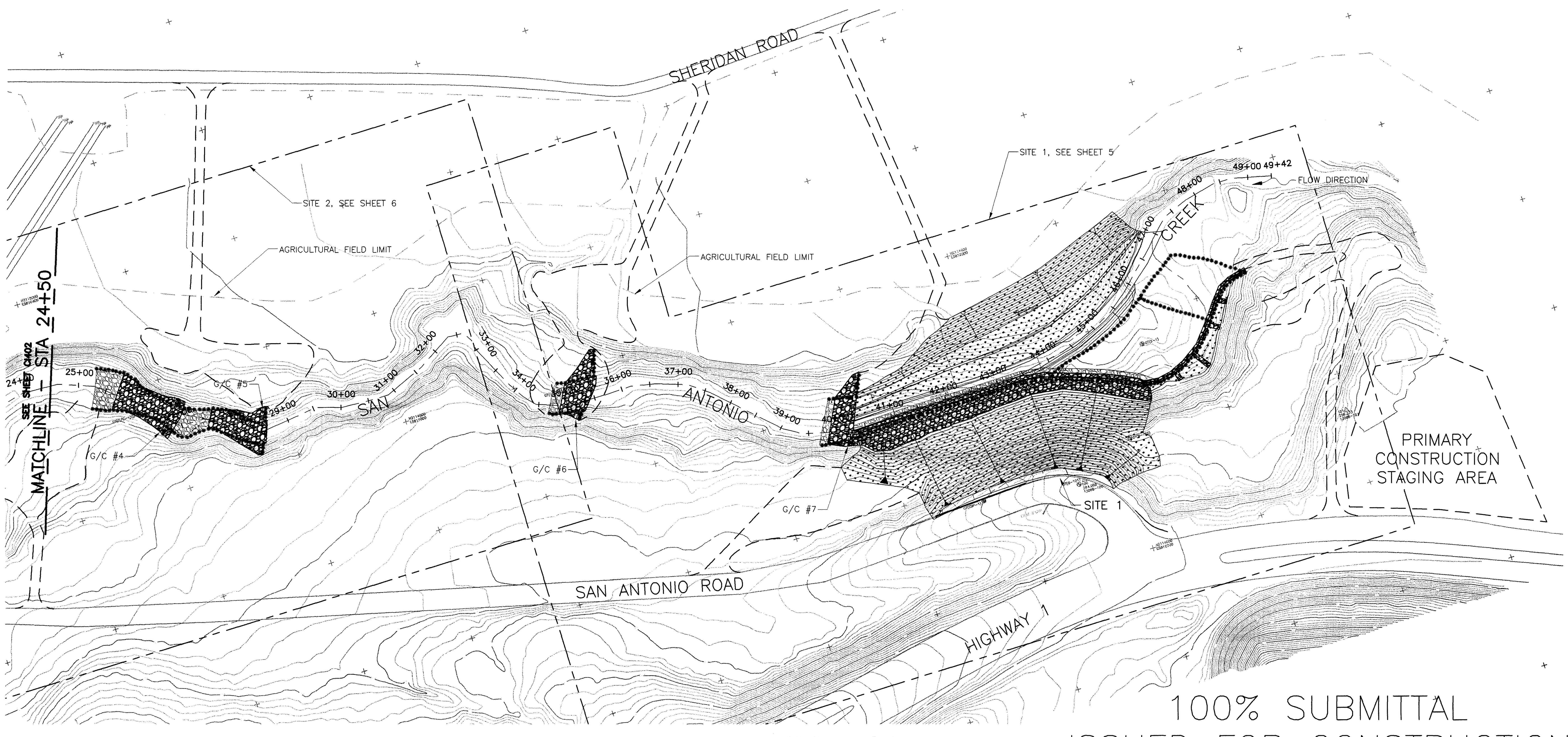
PROJECT # 09-1128B2
DRAWING # G002
2 OF 9
SHEET #



NOTES:
1. LONGITUDINAL STRUCTURES AND TOP OF CHANNEL STATIONING SHOWN PROJECTED PERPENDICULAR TO CHANNEL CENTERLINE.
2. FOR EXACT LOCATION AND HEIGHT OF LONGITUDINAL STRUCTURES, SEE SHEETS 5, 6, AND 7. SOME ELEVATIONS MAY NEED TO BE FIELD MODIFIED PER ONSITE ENGINEER.
3. GRADE CONTROL ROCK IS SHOWN ALONG CENTELRINE PROFILE. KEY ROCK (TO 100-YEAR WSE) NOT SHOWN.

PROFILE STATION 24+50 TO 50+00

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=10'



GENERAL PLAN

100% SUBMITTAL
ISSUED FOR CONSTRUCTION

SCALE: 1"= 100'-0"

U.S. AIR FORCE
SPACE COMMAND
VANDENBERG AFB

PROJECT TITLE	SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE	GENERAL PLAN AND PROFILE
SCALE	AS NOTED
DATE	02/22/08
DRAWN	JSR
DESIGNED	JSR/SRD
REVIEWED	BJD
PROJECT #	09-1128B2
DRAWING #	C401
SHEET #	3 OF 9

SYMBOL | DESCRIPTION OF REVISION | DATE

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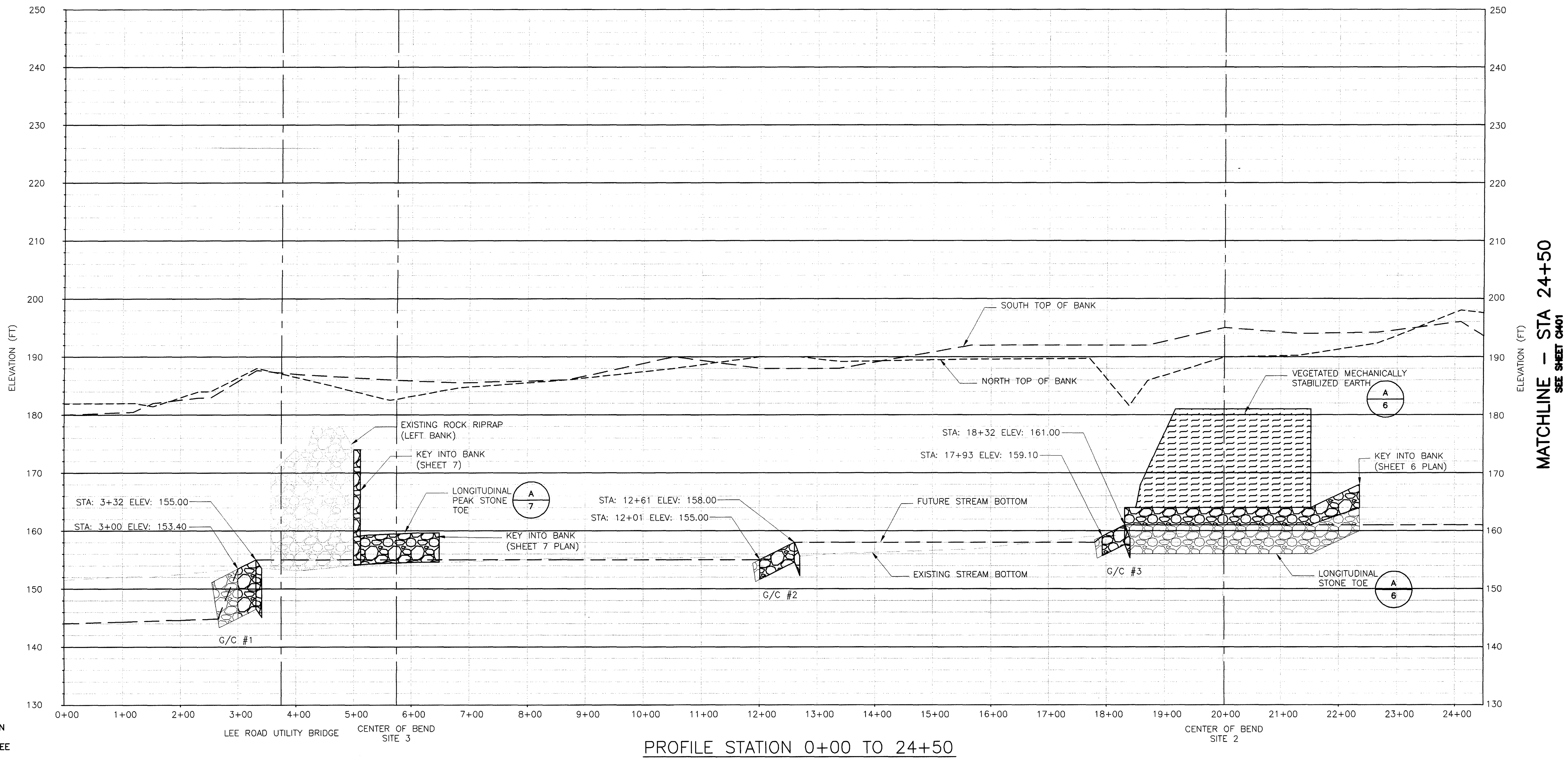
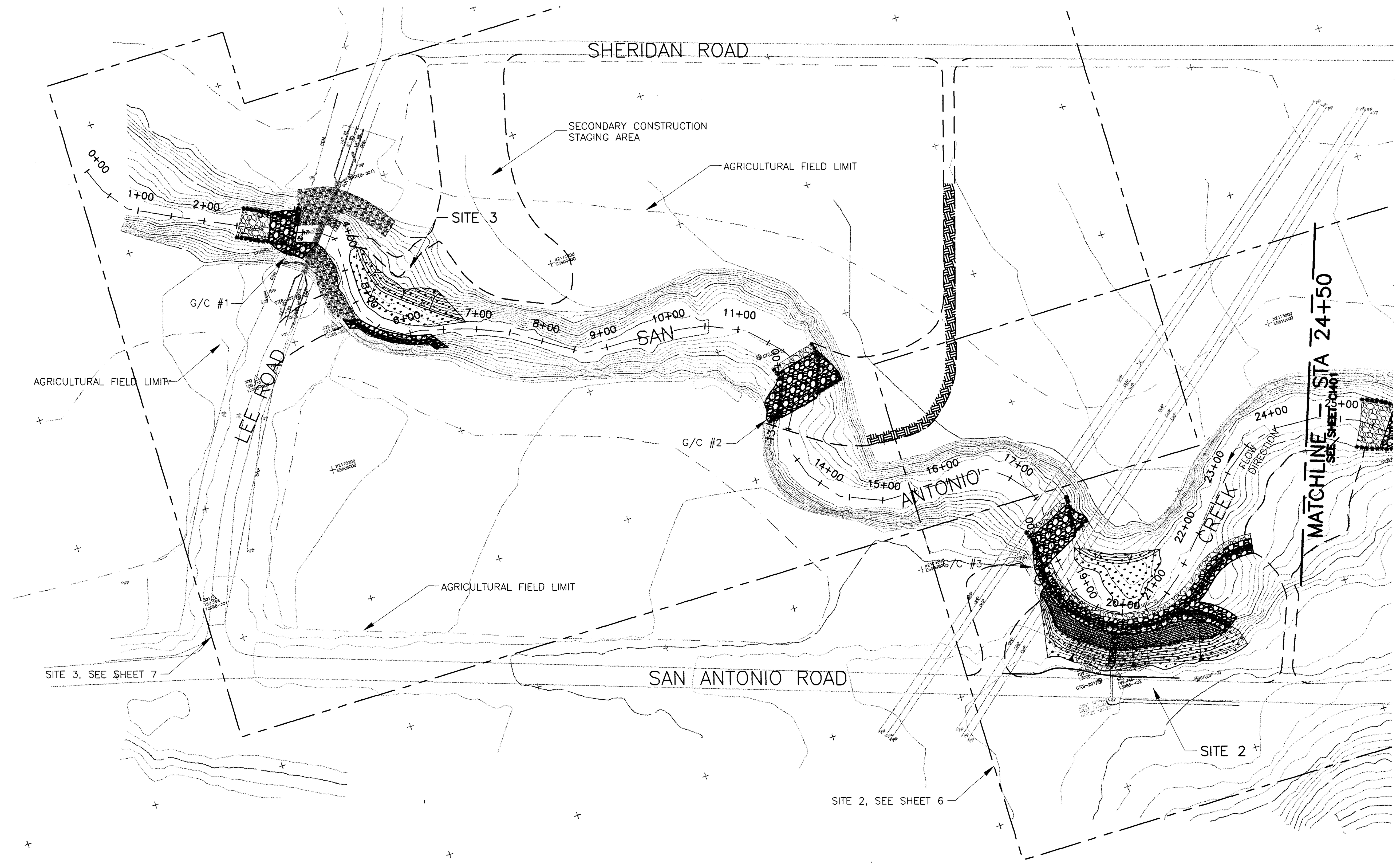


PROFILE STATION 0+00 TO 24+50

HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=10'

NOTES:
1. LONGITUDINAL STRUCTURES AND TOP OF CHANNEL STATIONING SHOWN PROJECTED PERPENDICULAR TO CHANNEL CENTERLINE.
2. FOR EXACT LOCATION AND HEIGHT OF LONGITUDINAL STRUCTURES, SEE SHEETS 5, 6, AND 7. SOME ELEVATIONS MAY NEED TO BE FIELD MODIFIED PER ONSITE ENGINEER.
3. GRADE CONTROL ROCK IS SHOWN ALONG CENTELRINE PROFILE. KEY ROCK (TO 100-YEAR WSE) NOT SHOWN.



GENERAL PLAN

SCALE: 1"= 100'-0"

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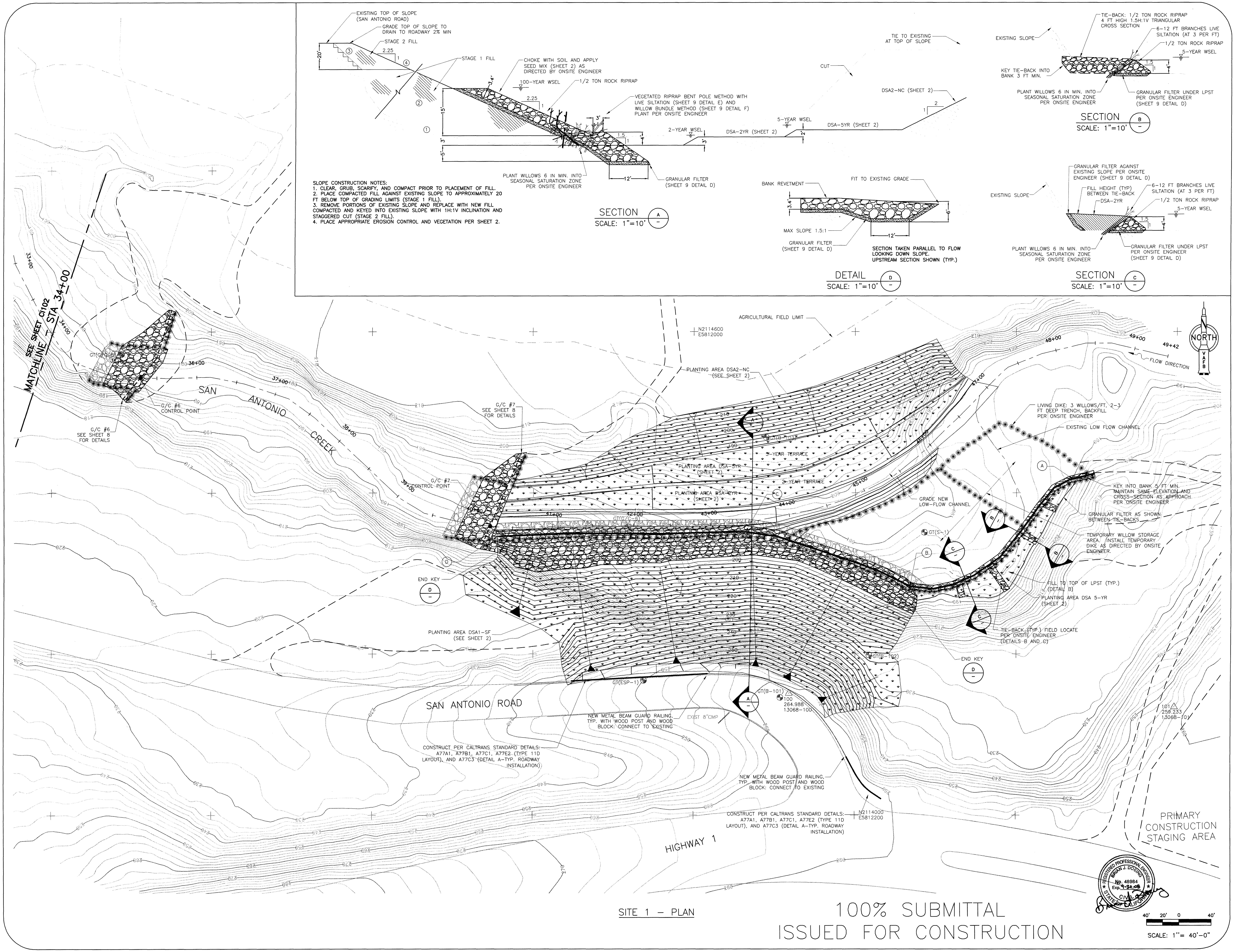
DRAWN JSR
DESIGNED JSR/SRD
REVIEWED BJD

PROJECT TITLE: SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE: GENERAL PLAN AND PROFILE
SCALE: AS NOTED
DATE: 02/22/08
PROJECT #: 09-112882
DRAWING #: C402
SHEET #: 4 OF 9

REGISTERED PROFESSIONAL ENGINEER BRIAN J. DOEING No. 48984 Exp. 9-30-09 CIVIL STATE OF CALIFORNIA



SITE 1 - PLAN

AIR FORCE SPACE COMMAND

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SYMBOL	DESCRIPTION OF REVISION	DATE

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DESIGNED: JSR/SRD
REVIEWED: BJD

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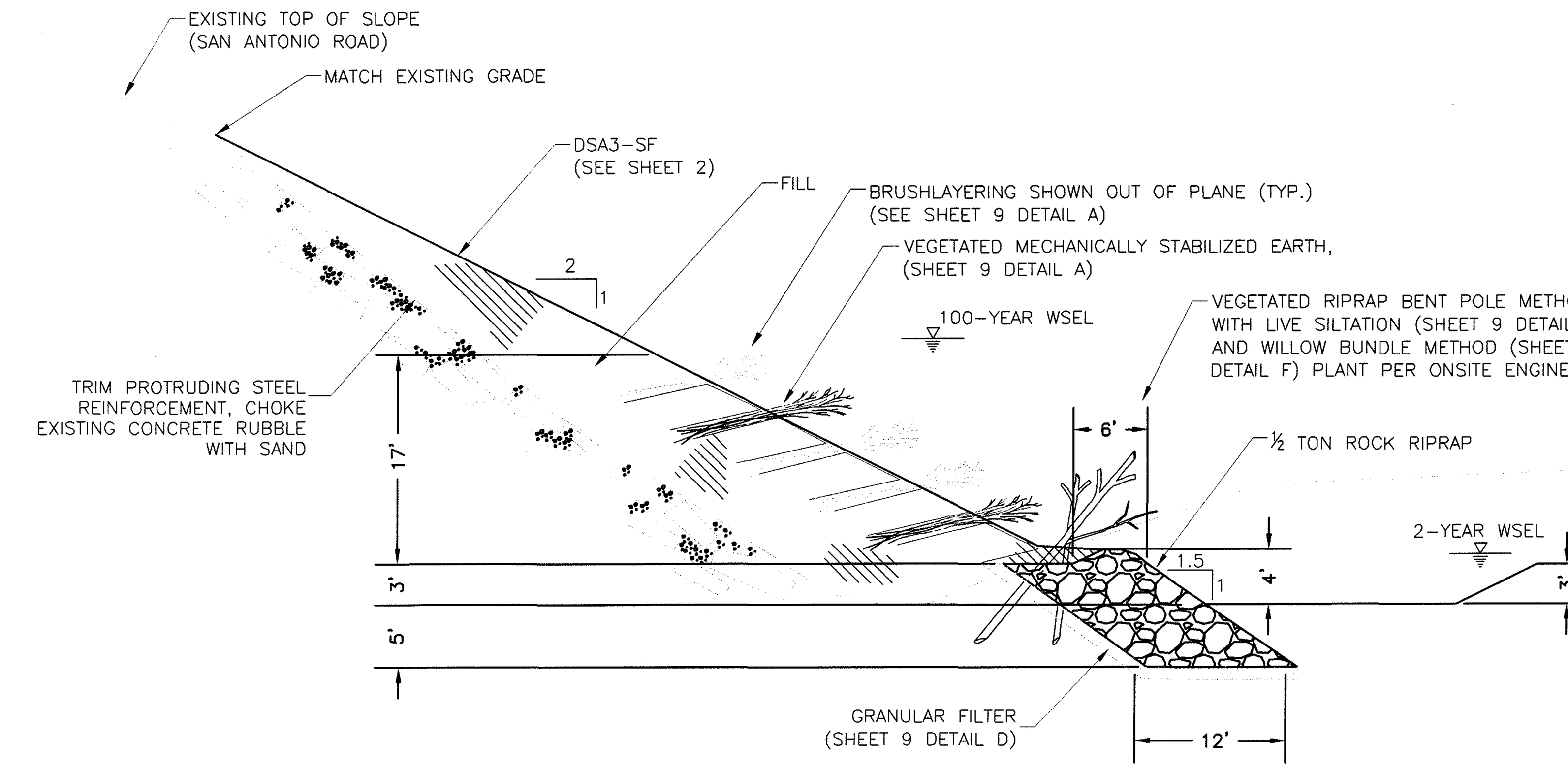
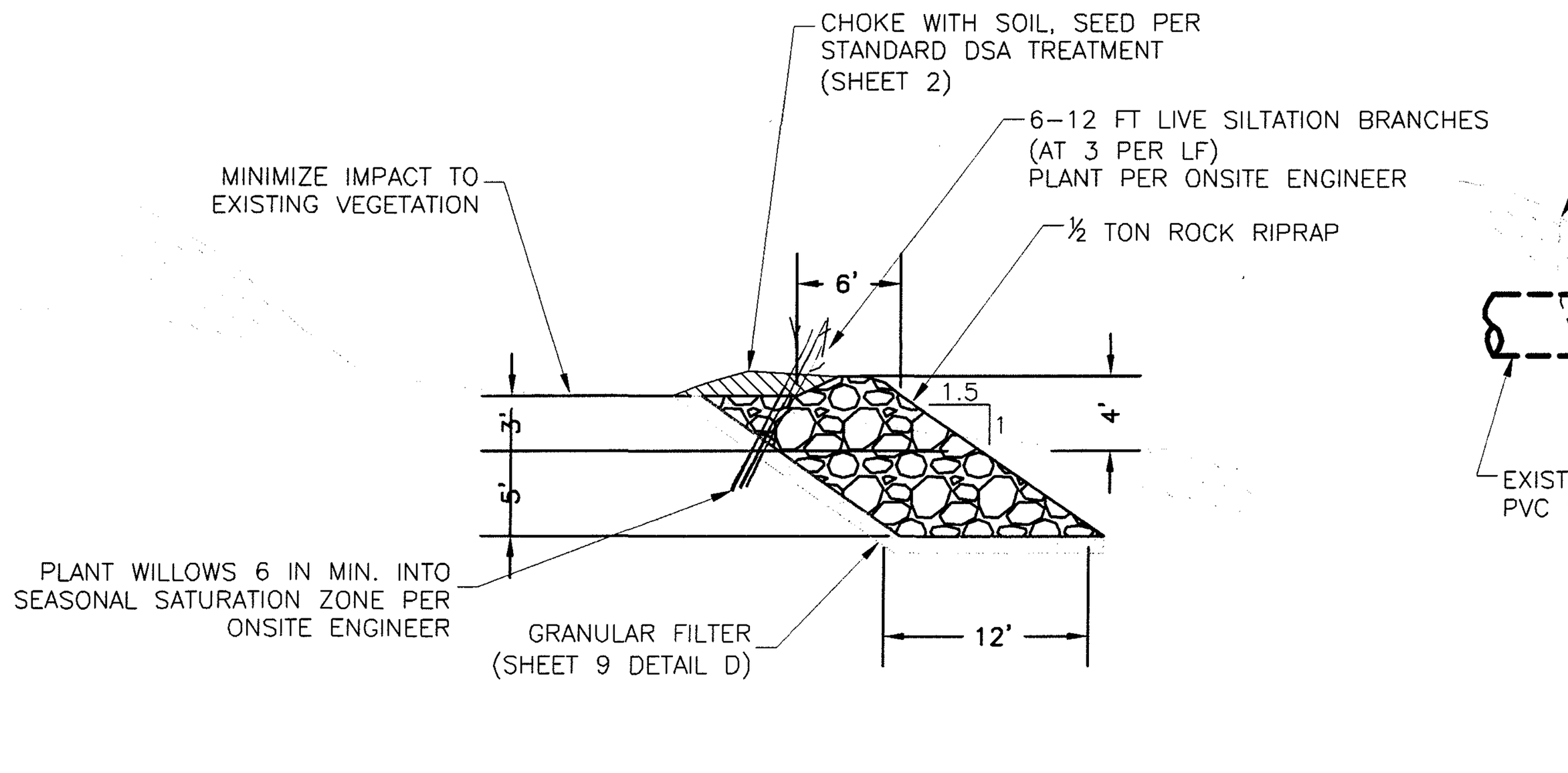
SPACE COMMAND
VANDENBERG AFB

PROJECT TITLE: SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE: SITE 1 - IMPROVMENT PLAN
SCALE: AS NOTED
DATE: 02/22/08

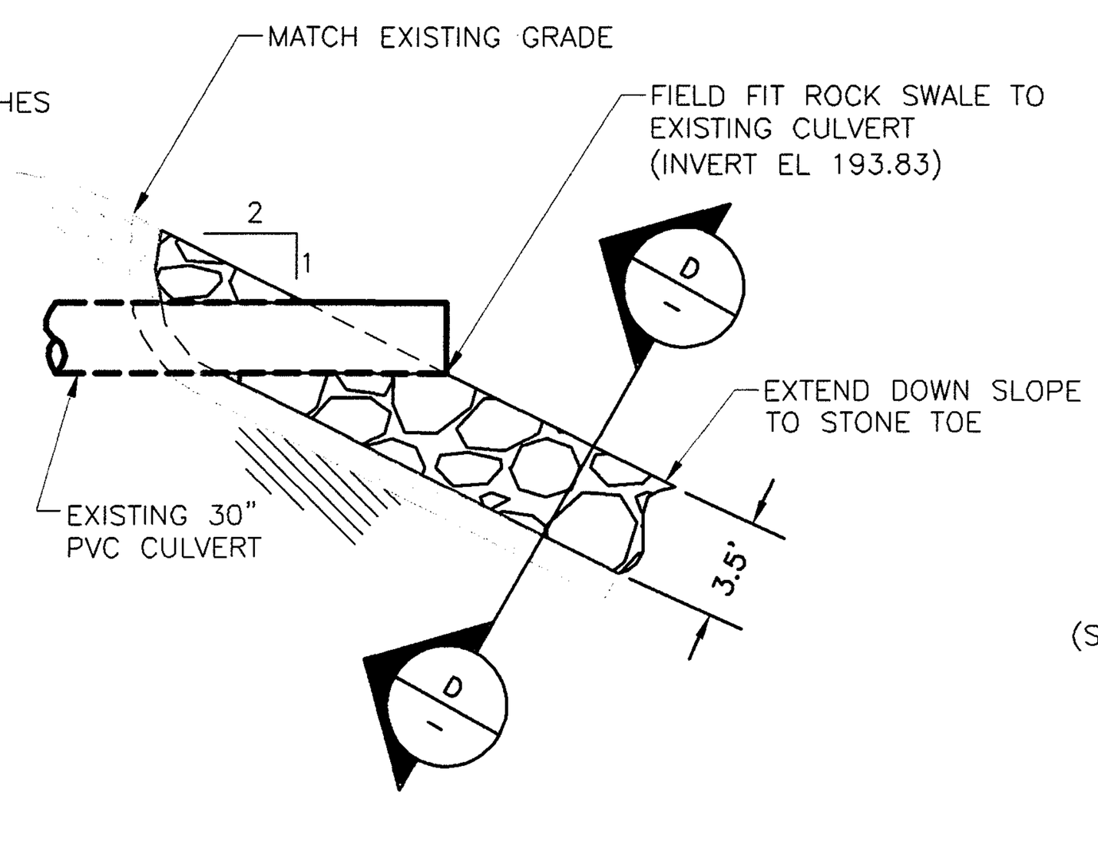
PROJECT #: 09-1128B2
DRAWING #: C101
SHEET #: 5 OF 9


EXISTING TOP OF SLOPE (SAN ANTONIO ROAD)
MATCH EXISTING GRADE
DSA3-SF (SEE SHEET 2)
FILL
BRUSHLAYERING SHOWN OUT OF PLANE (TYP.) (SEE SHEET 9 DETAIL A)
VEGETATED MECHANICALLY STABILIZED EARTH, (SHEET 9 DETAIL A)
100-YEAR WSEL
TRIM PROTRUDING STEEL REINFORCEMENT, CHOKE EXISTING CONCRETE RUBBLE WITH SAND
VEGETATED RIPRAP BENT POLE METHOD WITH LIVE SILTATION (SHEET 9 DETAIL E) AND WILLOW BUNDLE METHOD (SHEET 9 DETAIL F) PLANT PER ONSITE ENGINEER
½ TON ROCK RIPRAP
DSA4-NC (SEE SHEET 2)
MATCH EXISTING GRADE
CUT
2-YEAR WSEL
DSA-2YR
GRANULAR FILTER (SHEET 9 DETAIL D)
6'
4'
12'
17'
3'
5'

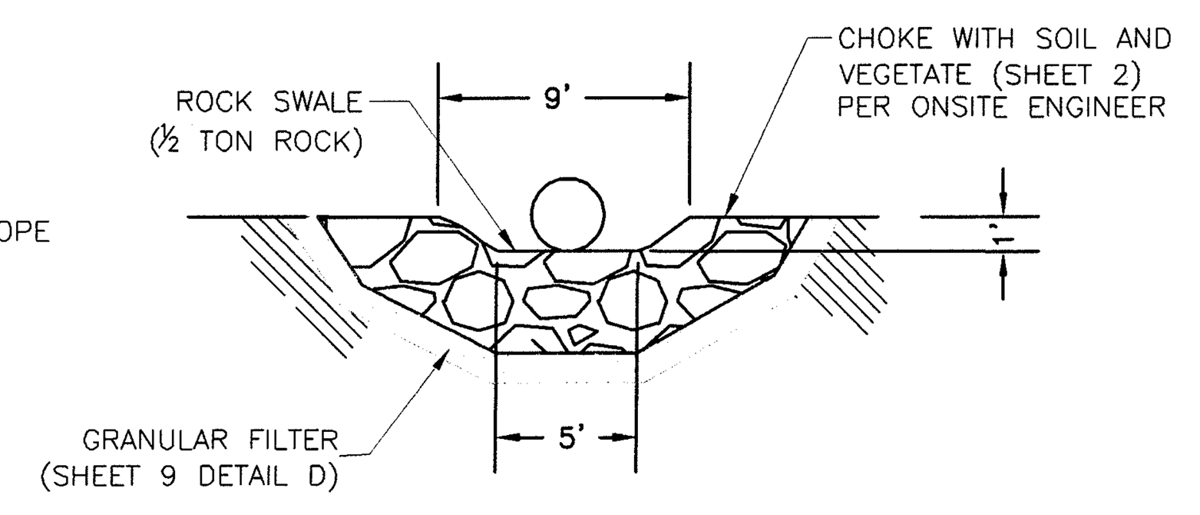
SECTION A
SCALE: 1"=10'


CHOKE WITH SOIL, SEED PER STANDARD DSA TREATMENT (SHEET 2)
6-12 FT LIVE SILTATION BRANCHES (AT 3 PER LF) PLANT PER ONSITE ENGINEER
½ TON ROCK RIPRAP
MINIMIZE IMPACT TO EXISTING VEGETATION
PLANT WILLOWS 6 IN MIN. INTO SEASONAL SATURATION ZONE PER ONSITE ENGINEER
GRANULAR FILTER (SHEET 9 DETAIL D)
6'
4'
12'

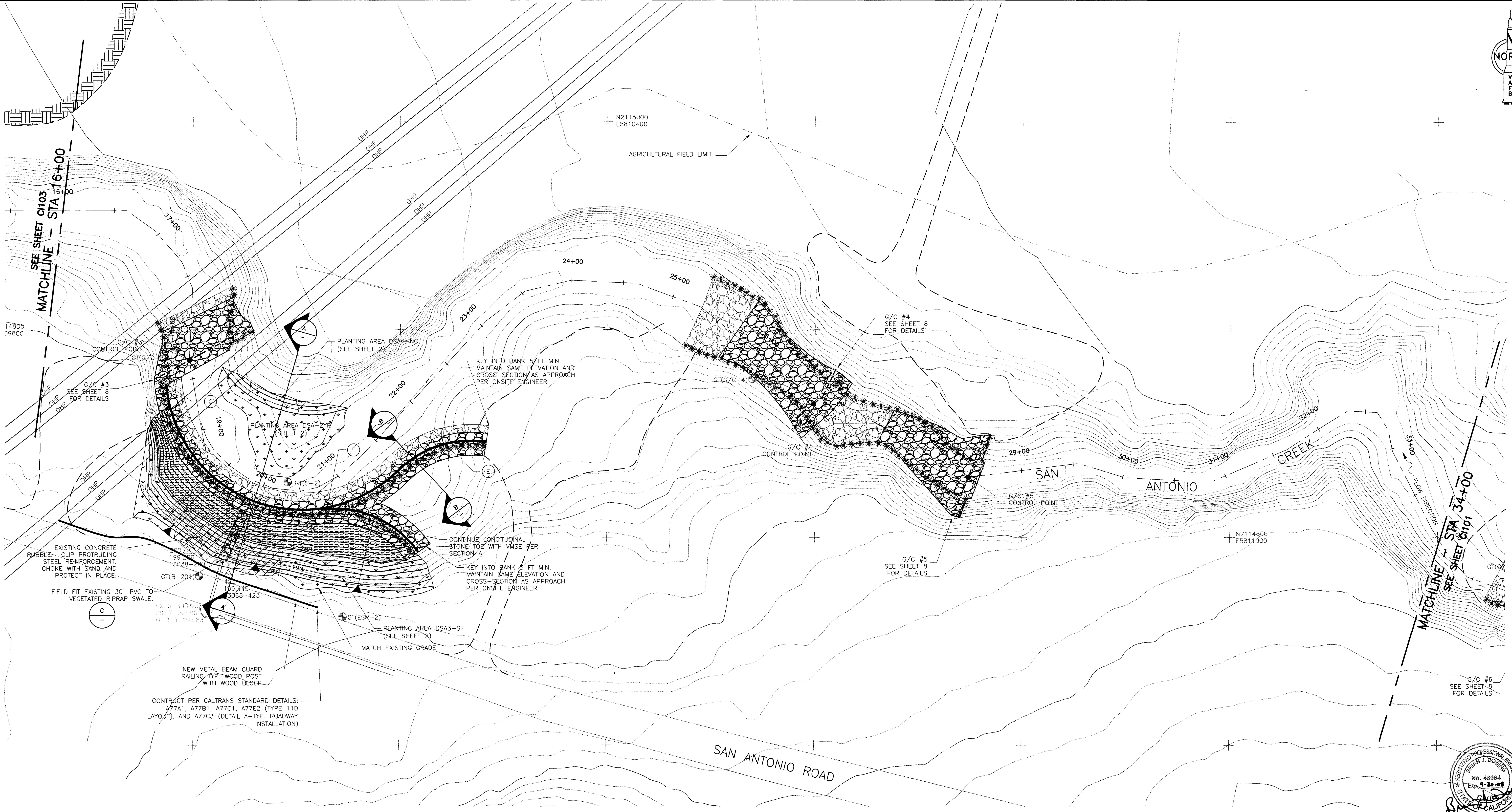
SECTION B
SCALE: 1"=10'



CULVERT OUTLET DETAIL C
SCALE: NTS



ROCK SWALE SECTION D
SCALE: NTS


NORTH
MATCHLINE - STA 16+00
SEE SHEET C103
N2115000 E5810400
AGRICULTURAL FIELD LIMIT
OHP
G/C #3 CONTROL POINT
G/C #3 SEE SHEET 8 FOR DETAILS
PLANTING AREA DSA4-NC (SEE SHEET 2)
KEY INTO BANK 5 FT MIN. MAINTAIN SAME ELEVATION AND CROSS-SECTION AS APPROACH PER ONSITE ENGINEER
PLANTING AREA DSA-2YR (SHEET 2)
CONTINUE LONGITUDINAL STONE TOE WITH VMSE PER SECTION A
KEY INTO BANK 5 FT MIN. MAINTAIN SAME ELEVATION AND CROSS-SECTION AS APPROACH PER ONSITE ENGINEER
EXISTING CONCRETE RUBBLE: CLIP PROTRUDING STEEL REINFORCEMENT. CHOKE WITH SAND AND PROTECT IN PLACE.
FIELD FIT EXISTING 30" PVC TO VEGETATED RIPRAP SWALE.
PLANTING AREA DSA3-SF (SEE SHEET 2)
MATCH EXISTING GRADE
NEW METAL BEAM GUARD RAILING TYP. WOOD POST WITH WOOD BLOCK
CONTRUCT PER CALTRANS STANDARD DETAILS: A77A1, A77B1, A77C1, A77E2 (TYPE 11D LAYOUT), AND A77C3 (DETAIL A-TYP. ROADWAY INSTALLATION)
G/C #4 SEE SHEET 8 FOR DETAILS
G/C #4 CONTROL POINT
G/C #5 CONTROL POINT
G/C #5 SEE SHEET 8 FOR DETAILS
SAN ANTONIO CREEK
FLOW DIRECTION
N2114600 E5811000
MATCHLINE - STA 34+00
SEE SHEET C101
G/C #6 SEE SHEET 8 FOR DETAILS
SAN ANTONIO ROAD
17+00
19+00
21+00
22+00
23+00
24+00
25+00
29+00
30+00
31+00
32+00
33+00

SITE 2 - PLAN

100% SUBMITTAL
ISSUED FOR CONSTRUCTION

SCALE: 1"= 40'-0"

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AIR FORCE SPACE COMMAND

SYMBOL	DESCRIPTION OF REVISION	DATE

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DESIGNED JSR/SRD
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U.S. AIR FORCE
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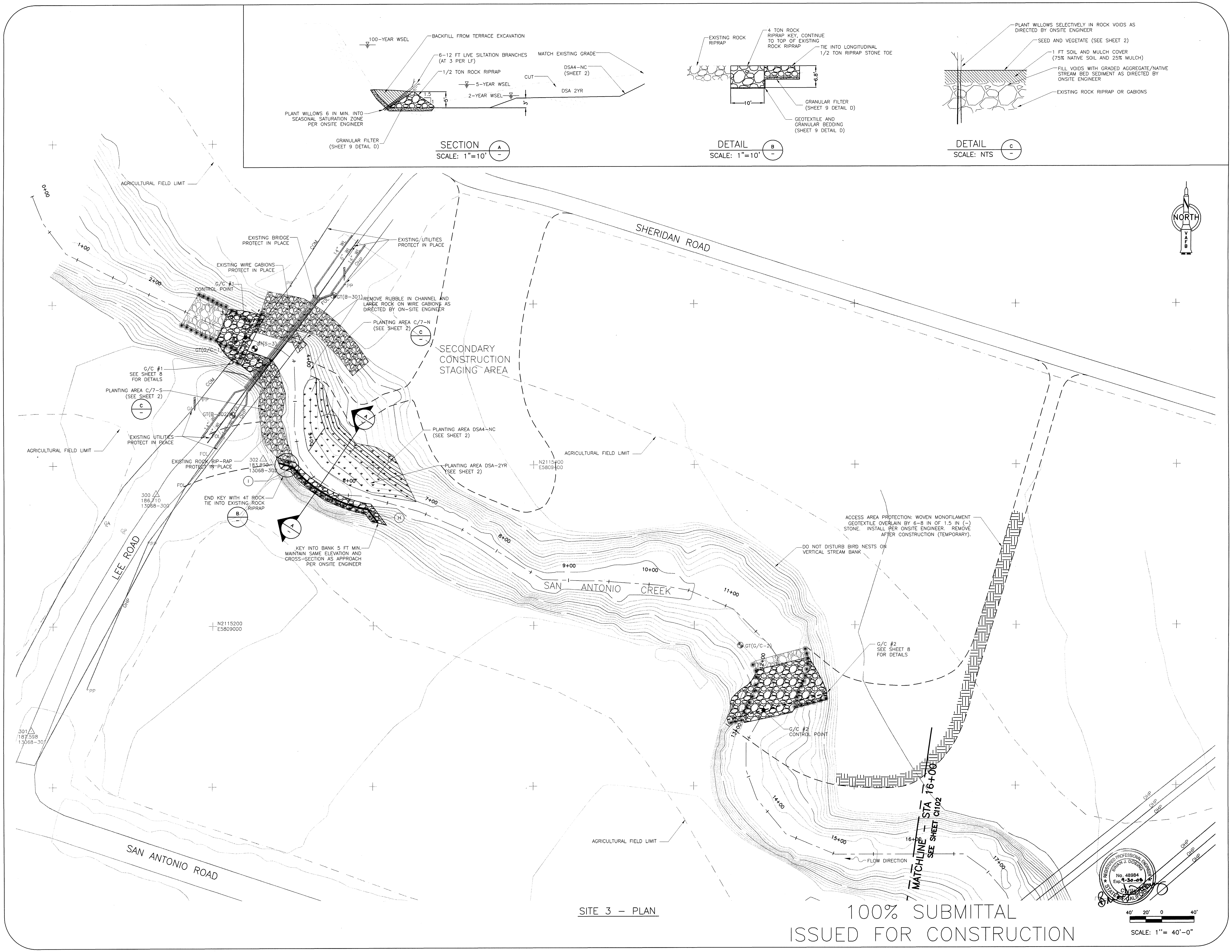
VANDENBERG AFB

PROJECT TITLE SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE SITE 2 - IMPROVEMENT PLAN
SCALE AS NOTED
DATE 02/22/08

PROJECT # 09-1128B2
DRAWING # C102
SHEET # 6 OF 9



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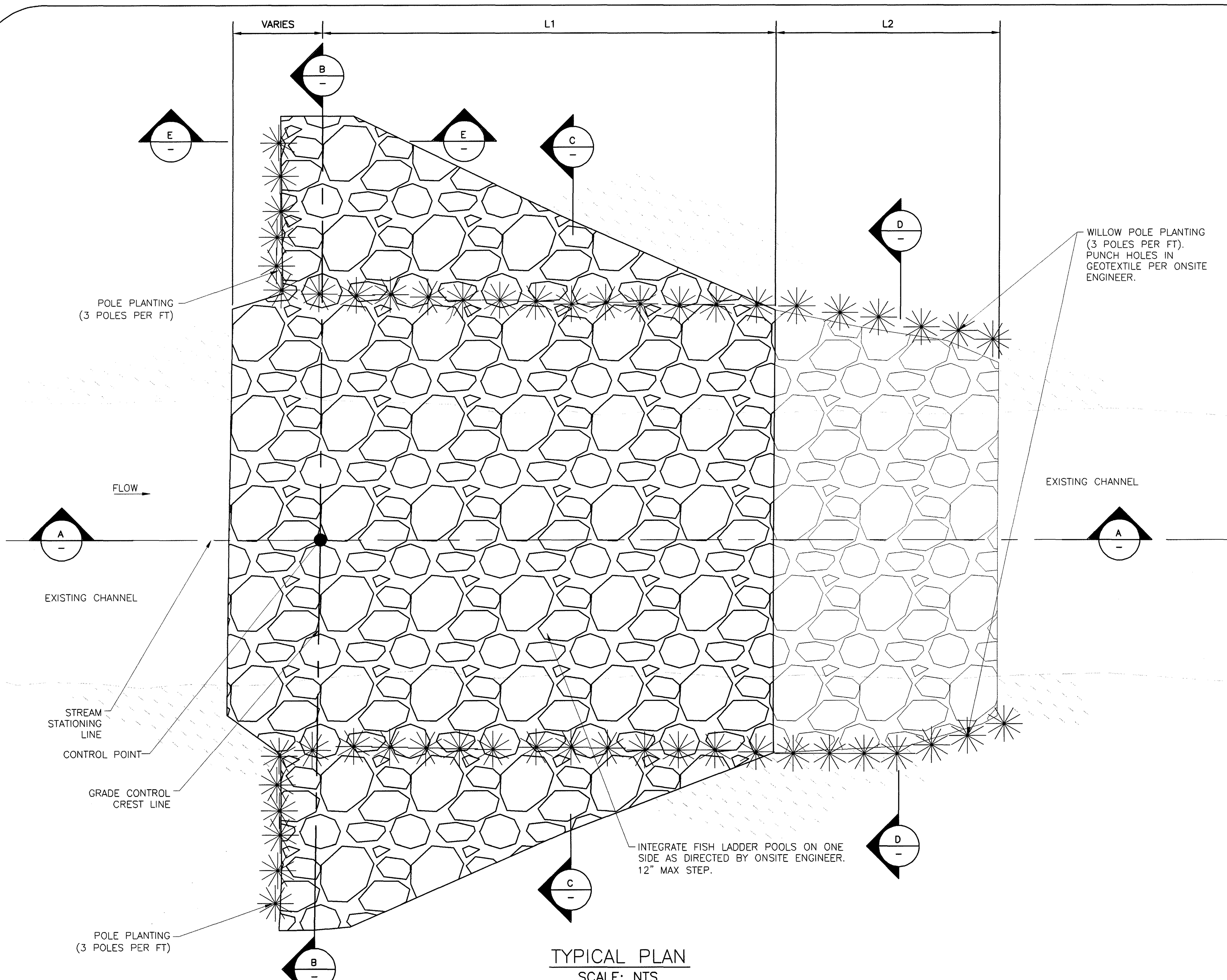
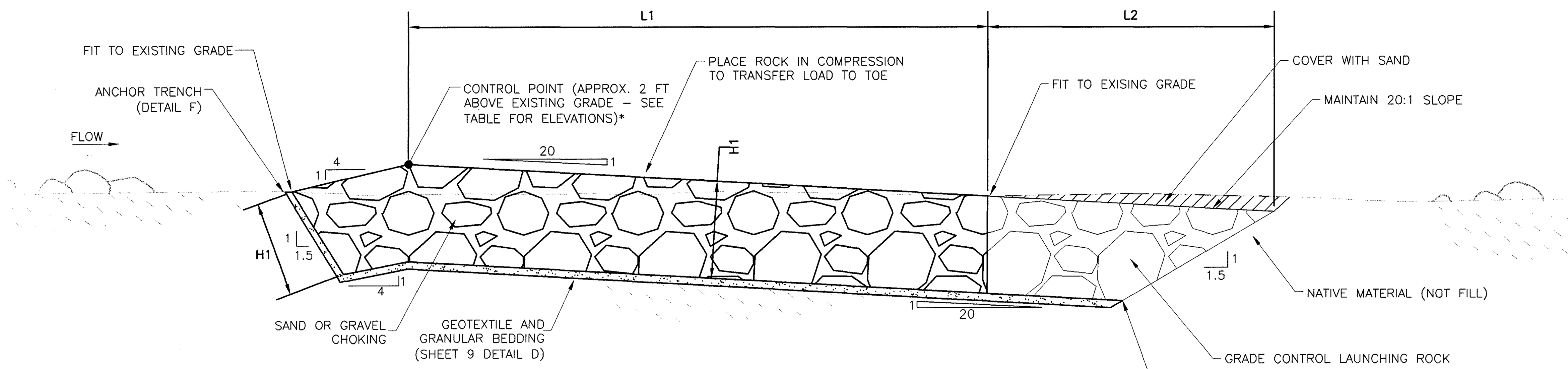
VANDENBERG AFB

PROJECT TITLE: SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE: SITE 3 - IMPROVEMENT PLAN
SCALE: AS NOTED
DATE: 02/22/08

PROJECT # 09-1128B2
DRAWING # C103
7 OF 9
SHEET #



TYPICAL PLAN
SCALE: NTS



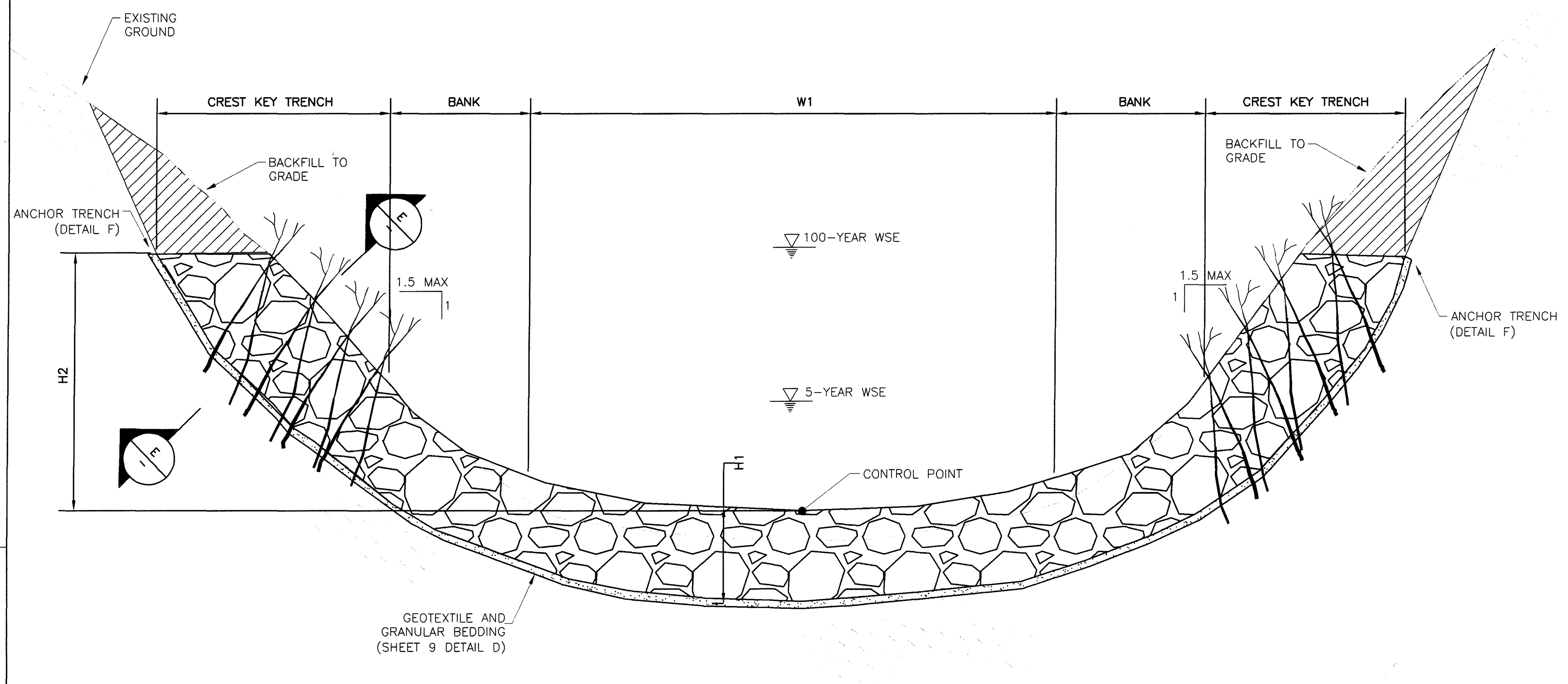
* ELEVATION OF CONTROL POINT TO BE DETERMINED BY FIELD SURVEY TO ELEVATIONS SHOWN IN THE TABLE BELOW. EXISTING BED ELEVATIONS MAY HAVE CHANGED SINCE SURVEY DATE (SEE SHEET 2).

TYPICAL PROFILE (A)
SCALE: NTS

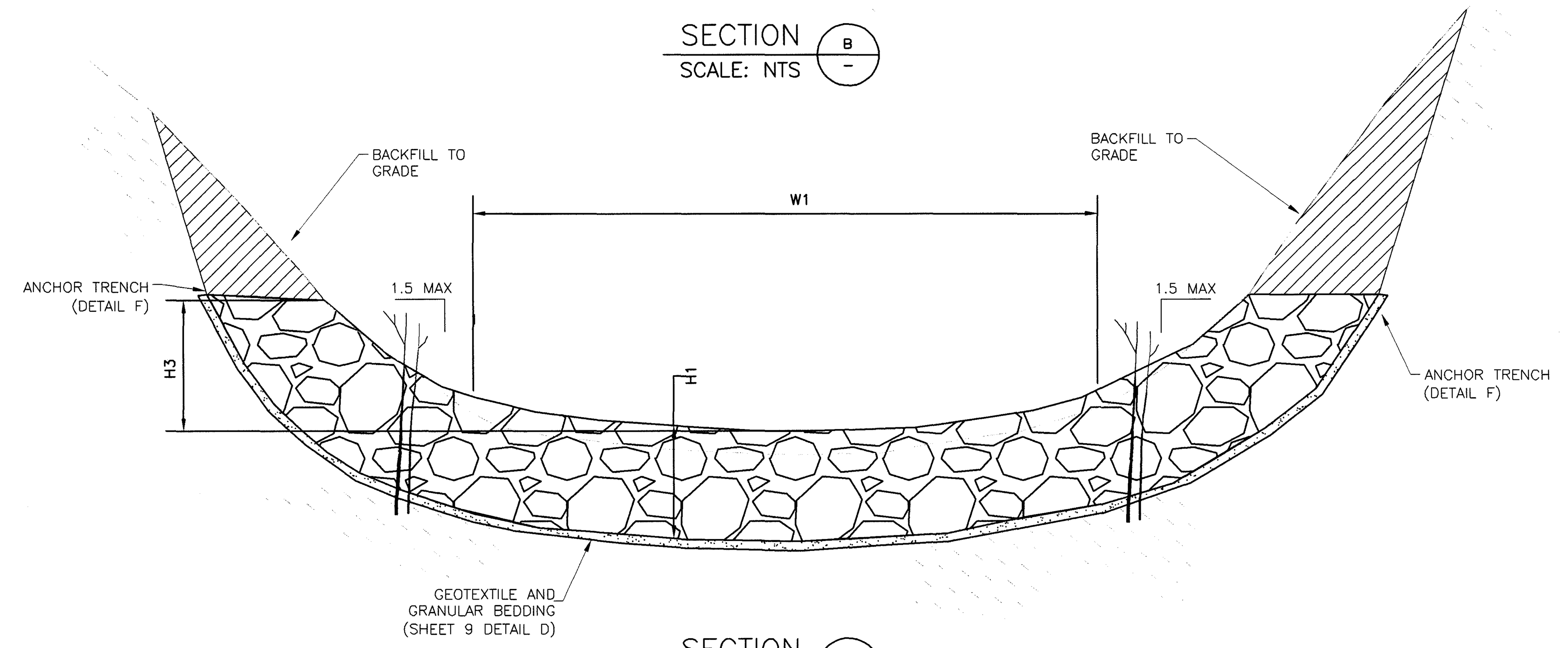
GRADE CONTROL STRUCTURE DIMENSIONS

GRADE CONTROL NO.	RIVER STATION	CONTROL POINT ELEVATION	CONTROL POINT NORTHING	CONTROL POINT EASTING	ROCK CLASS	H1 (FT)	H2 (FT)	H3 (FT)	H4 (FT)	W1 (FT)	L1 (FT)	L2 (FT)
1	3+32	155.00	2115559.65	5809041.50	8 TON	8.5	14	7	4	20	32	46
2	12+61	158.00	2115096.74	5809697.48	½ TON	3.4	21	7	6	17	60	12
3	18+32	161.00	2114772.66	5809999.75	½ TON	3.4	20	6	5	25	60	14
4	26+72	166.00	2114733.99	5810604.92	8 TON	8.5	13	5	4	25	125	18
5	28+51	171.00	2114657.89	5810747.89	8 TON	8.5	15	7	4	16	100	25
6	35+30	176.00	2114543.12	5811311.39	4 TON	6.8	18	8	5	14	40	20
7	40+23	179.00	2114358.65	5811746.10	½ TON	3.4	17	6	4	25	52	14

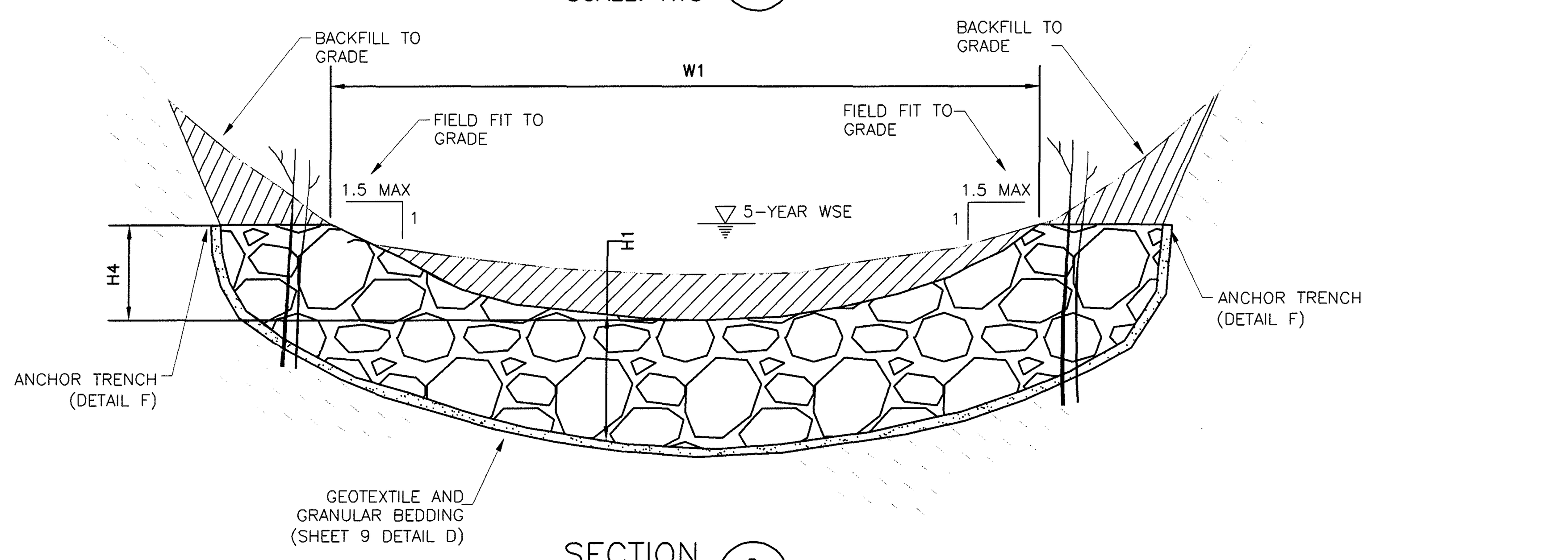
NOTES:
1. ROCK RIFFLE SHALL BE CONSTRUCTED SUCH THAT THE WEIR CREST (SECTION B) IS PERPENDICULAR TO DESIRED FLOW DIRECTION AS DIRECTED BY ONSITE ENGINEER.
2. ROCK SHALL BE PLACED IN COMPRESSION.
3. FISH PASSAGE SHALL BE MAINTAINED OVER ROCK RIFFLE. (1 FT MAX STEP AND 20:1 SLOPE).
4. AFTER PLACEMENT OF ROCK RIPRAP, SLUICE SAND AND GRAVEL INTO VOIDS.
5. ALL ROCK RIFFLE CONSTRUCTION SHALL BE DIRECTED BY ONSITE ENGINEER.



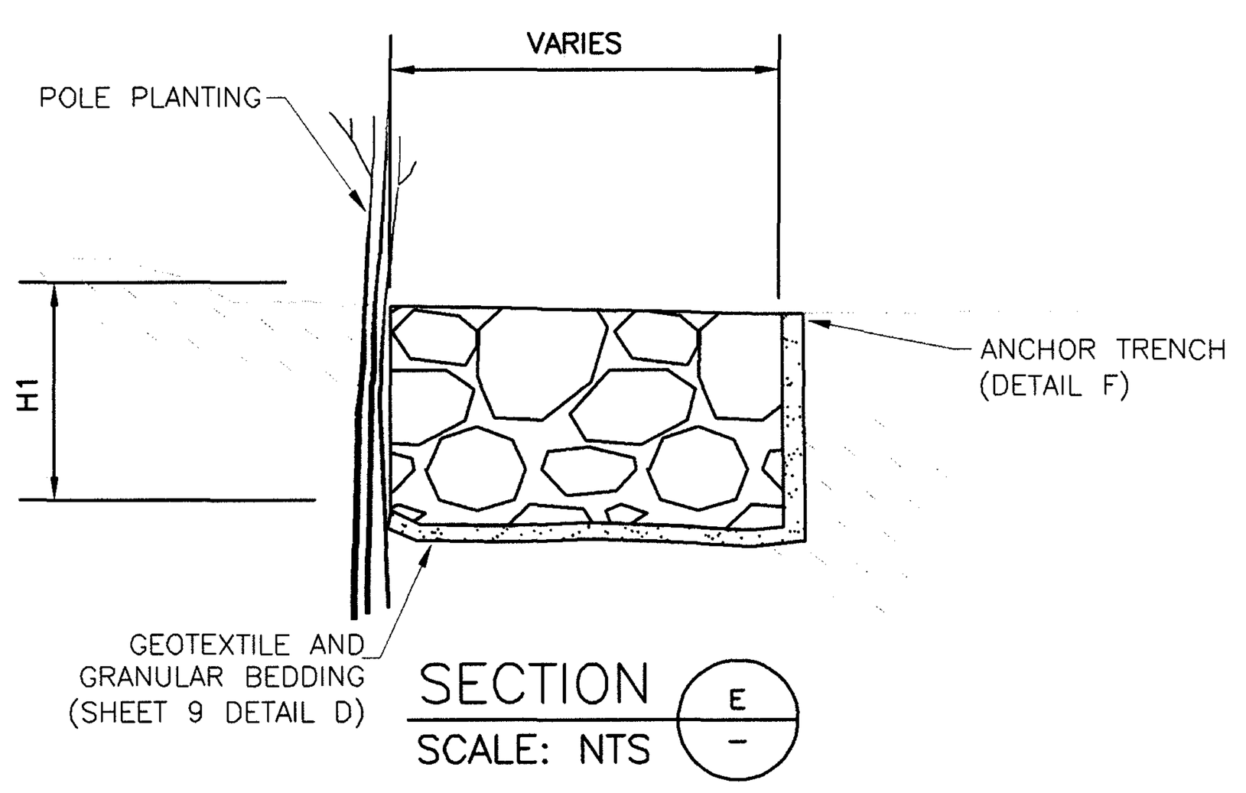
SECTION (B)
SCALE: NTS



SECTION (C)
SCALE: NTS



SECTION (D)
SCALE: NTS



SECTION (E)
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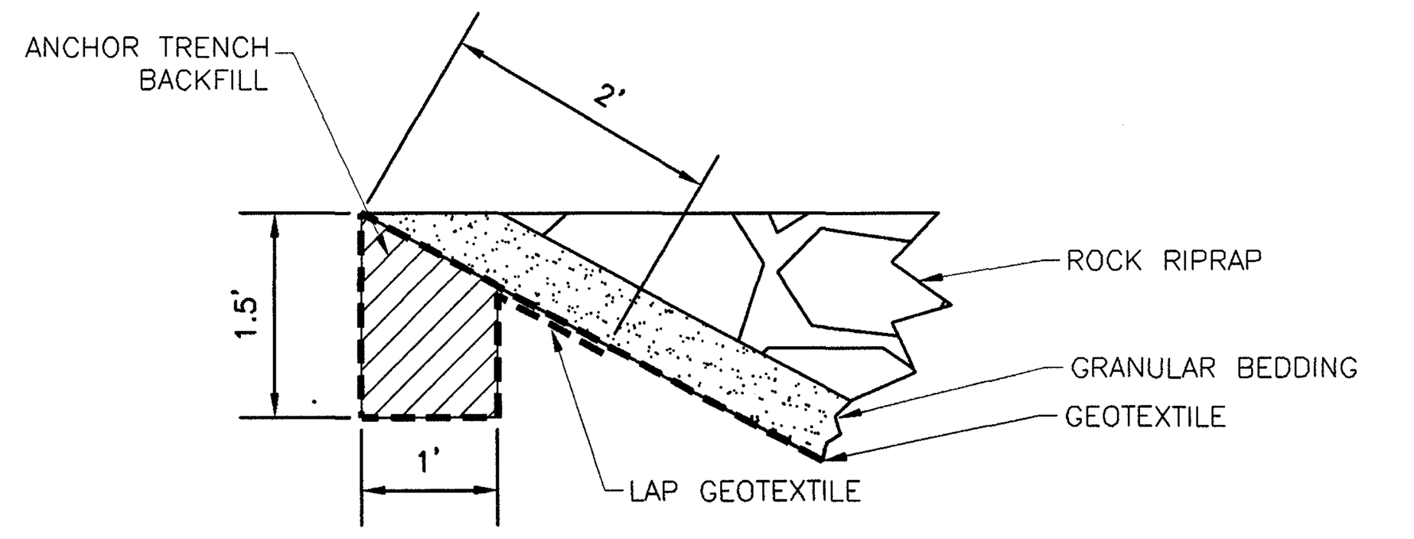


ANCHOR TRENCH DETAIL (F)
SCALE: NTS

ROCK RIFFLE GRADE CONTROL STRUCTURES

100% SUBMITTAL
ISSUED FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER BRIAN J. DOEING No. 48984 Exp. 9-30-09 CIVIL STATE OF CALIFORNIA

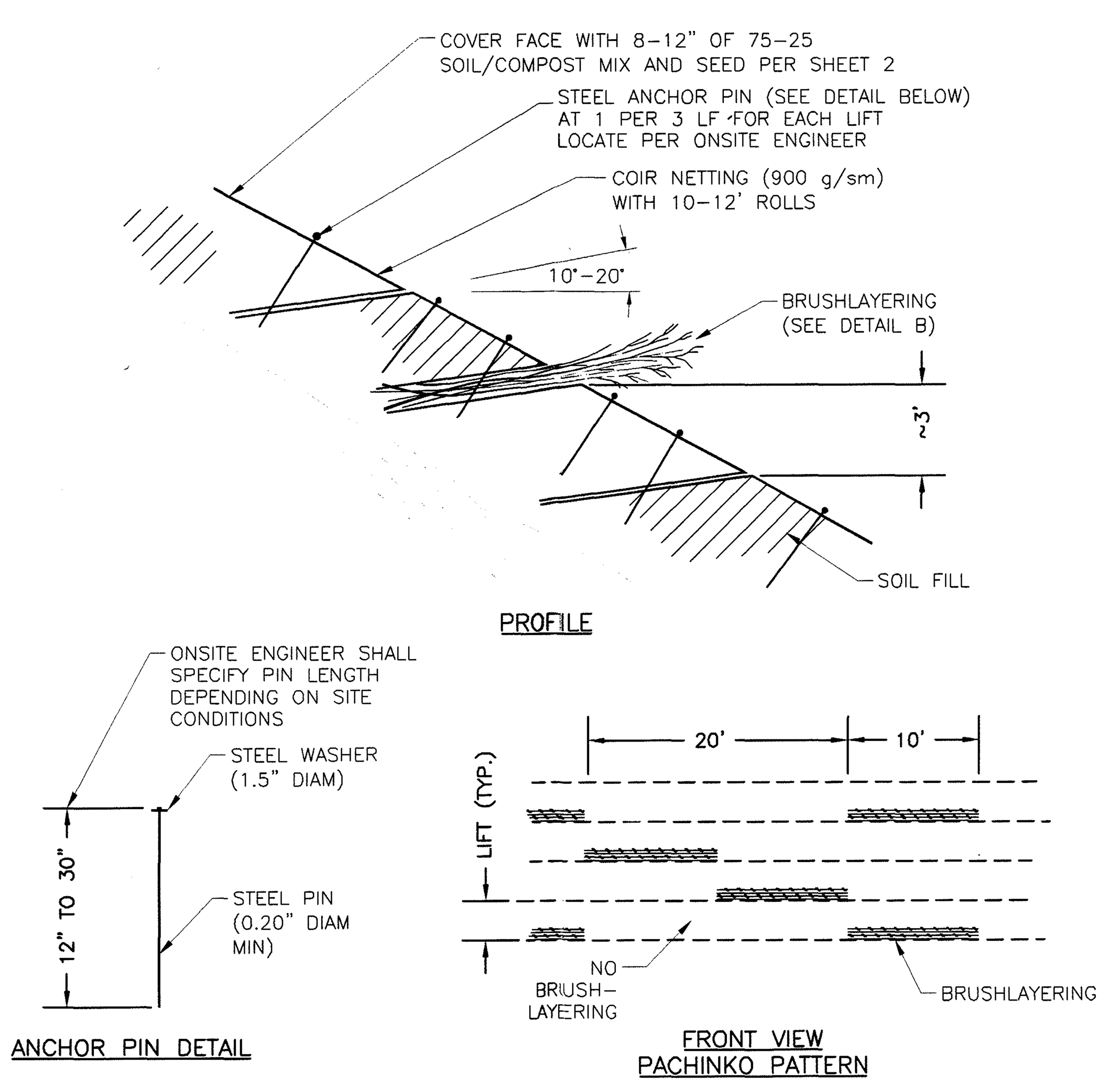
SYMBOL | DESCRIPTION OF REVISION | DATE

DRAWN JSR
DESIGNED JSR/SRD
REVIEWED BJD

U.S. AIR FORCE
SPACE COMMAND
VANDENBERG AFB

PROJECT TITLE SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE TYPICAL DETAILS
DATE 02/22/08
SCALE AS NOTED

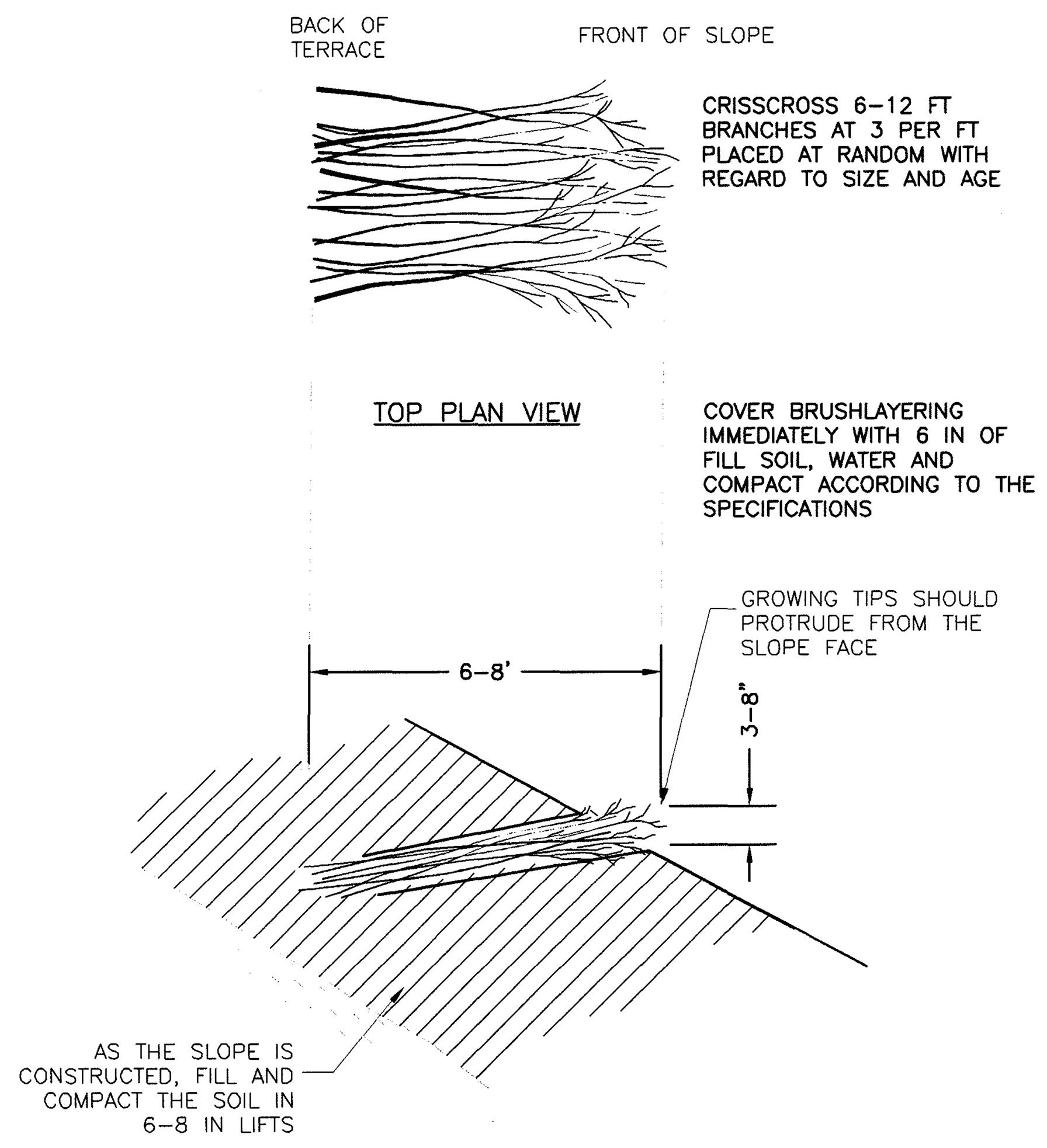
PROJECT # 09-1128B2
DRAWING # C501
8 OF 9
SHEET #



1. EACH LIFT (TERRACE) WILL BE 3 FT VERTICAL, DIPPED BACK 10–20'. THE OUTER 3–4 FT OF TERRACE WILL BE TRACK COMPACTED ONLY.
2. ON EACH TERRACE ROLL OUT, IN THE DIRECTION OF FLOW, THE ~11 FT WIDE COIR NETTING (900g/sm), LEAVING 5 FT ON TERRACE AND FLAPPING ~6 FT OVER THE FACE OF THE SLOPE.
3. EACH TERRACE WILL HAVE 10 LF OF BRUSHLAYERING FOLLOWED BY 20 LF OF NO BRUSHLAYERING. THE BRUSHLAYERING WILL BE STAGGERED WITH THE NEXT TERRACE, FOLLOWING THE PACHINKO PATTERN (SEE DETAIL) AND PER THE ONSITE ENGINEER.
4. THE OUTER 8–12 IN OF FACE WILL HAVE A 75% SOIL FILL, 25% COMPOST MIX (NOT COMPACTED) AND KEPT AT 15–20% MOISTURE.

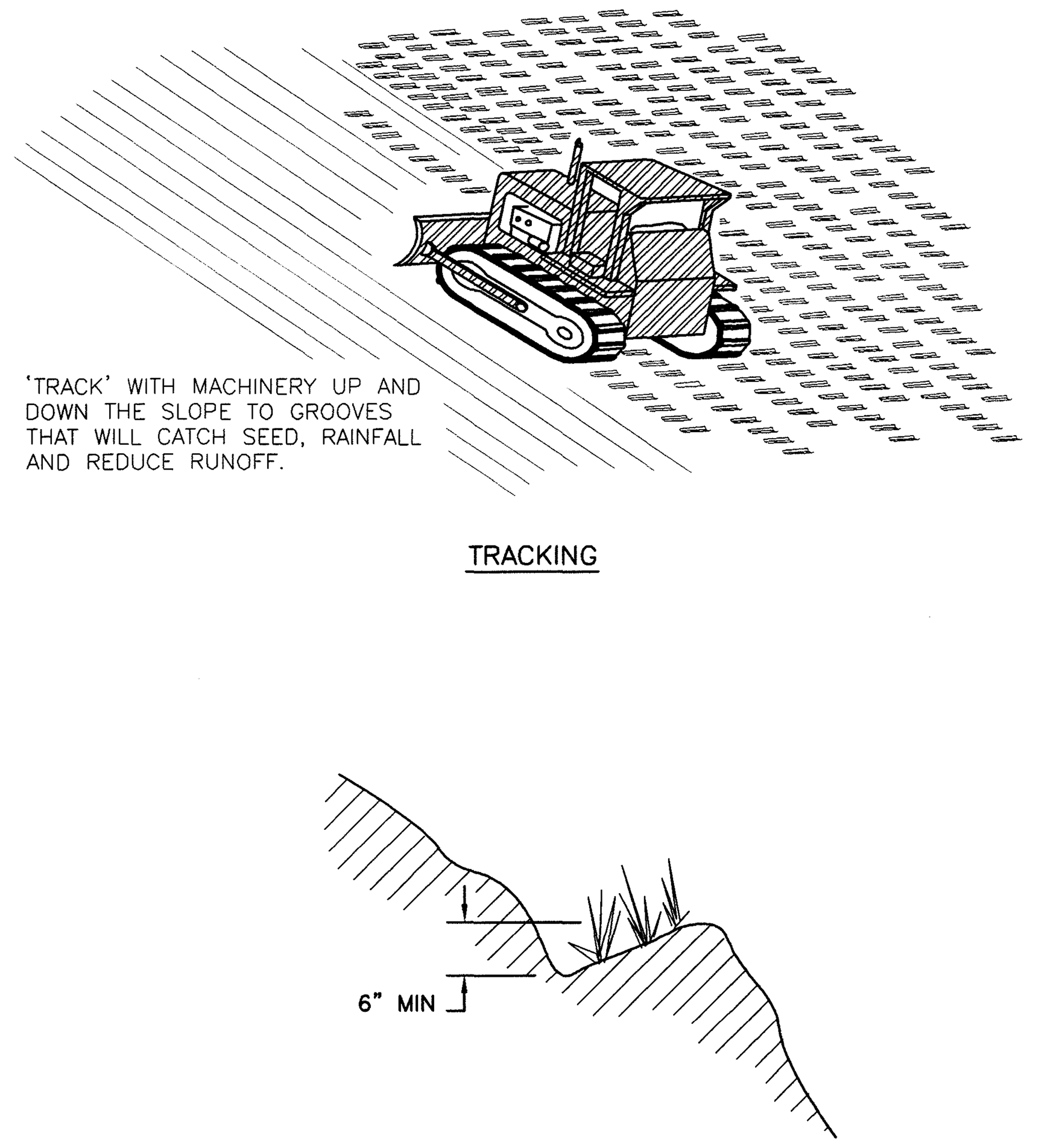
TYP. MODIFIED VEGETATED MECHANICALLY STABILIZED EARTH
(SOIL FLAP METHOD)

DETAIL A
SCALE: NTS –



TYPICAL BRUSHLAYERING WITH SLOPE PROTECTION

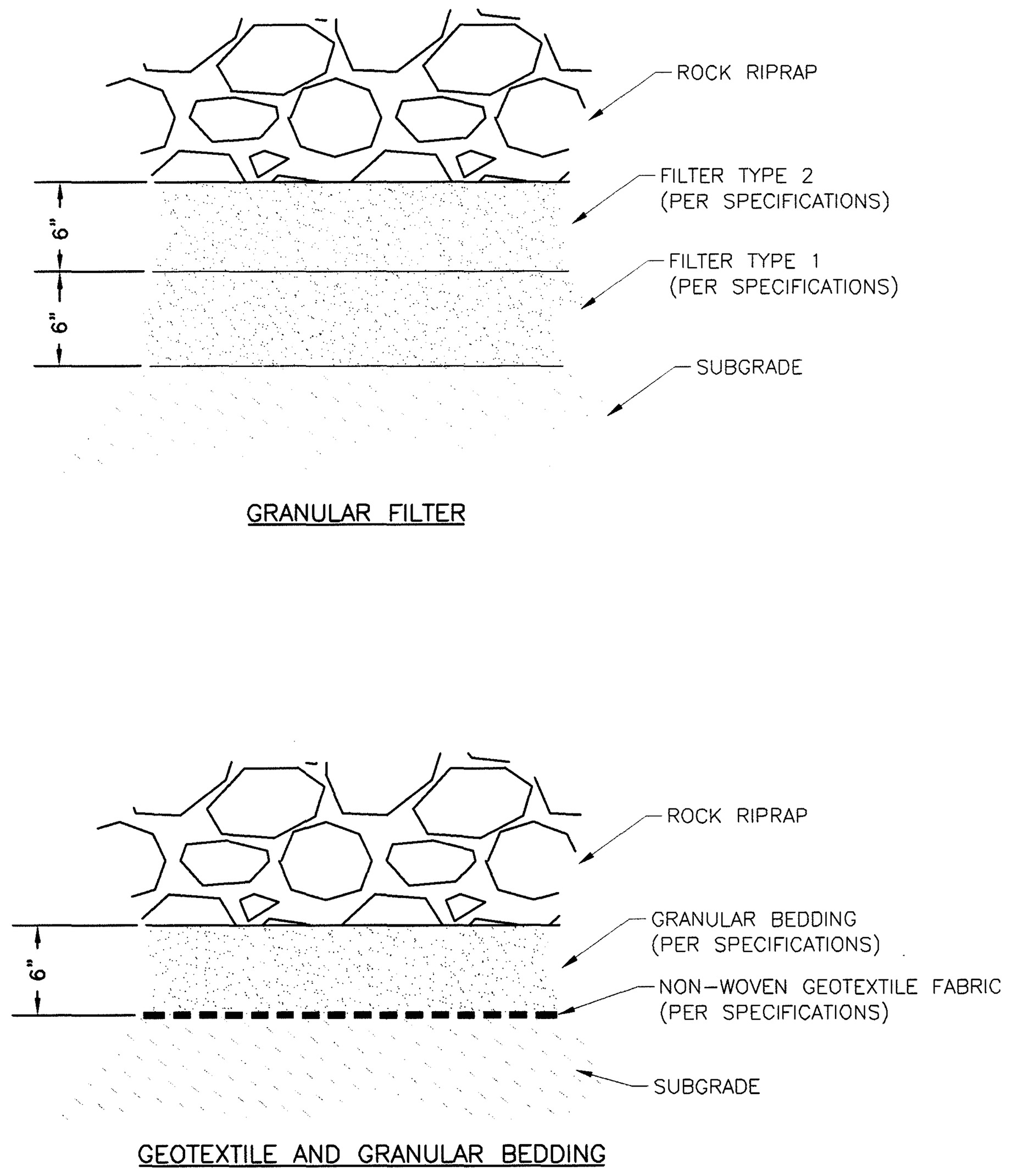
DETAIL B
SCALE: NTS –



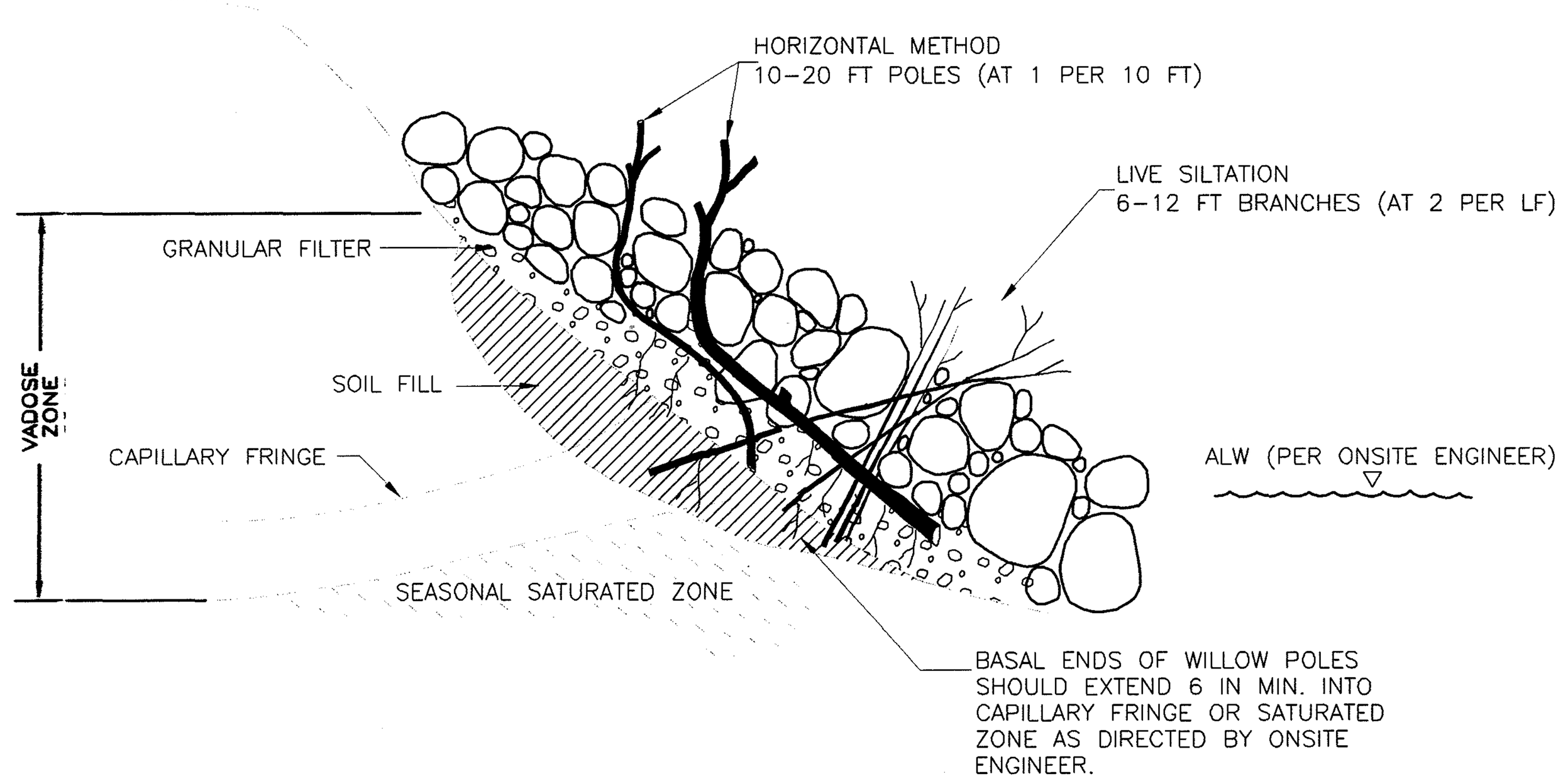
SOURCE: SALIX EARTHCARE INC.

SURFACE ROUGHENING

DETAIL C
SCALE: NTS –



DETAIL D
SCALE: NTS –

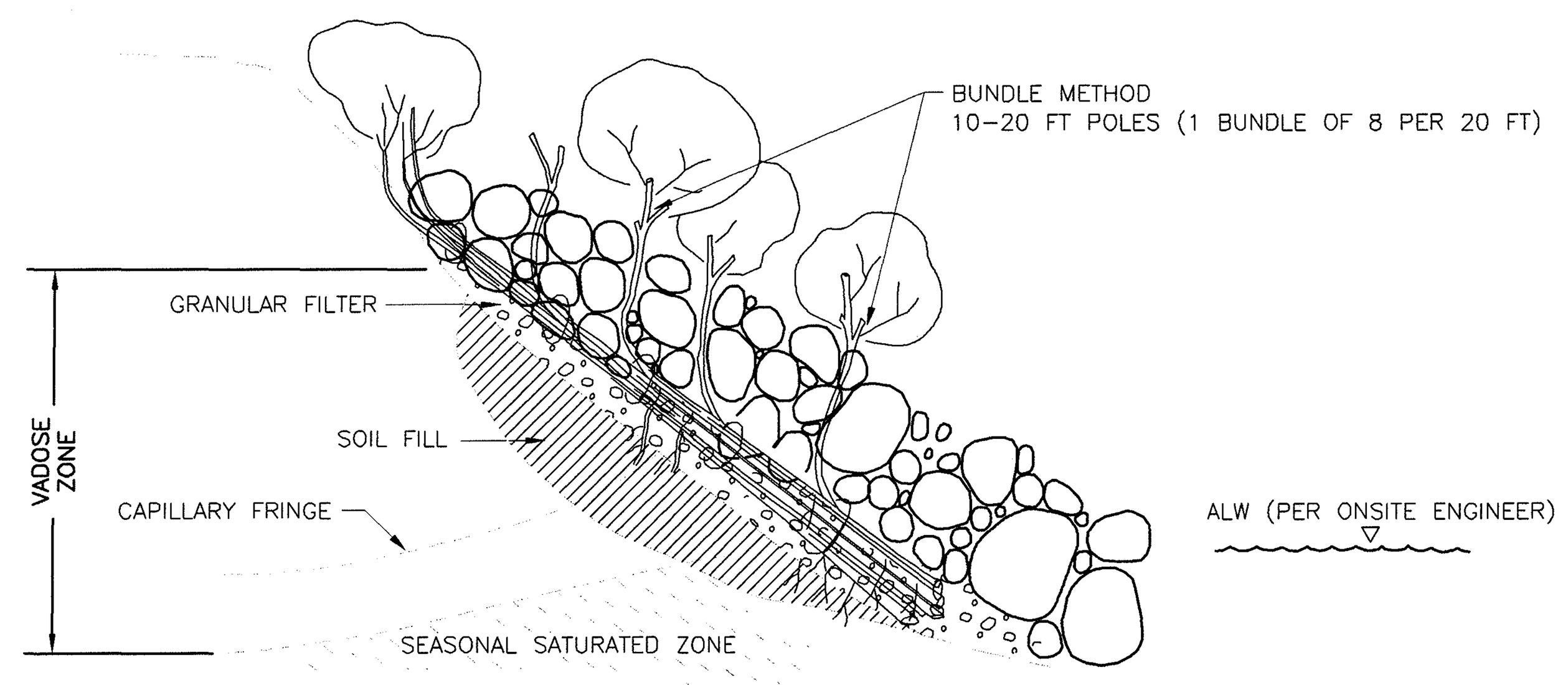


NOTES:
1. INTEGRATE POLE PLANTING AND LIVE SILTATION TECHNIQUES DURING ROCK PLACEMENT TO ENSURE CONTACT WITH NATIVE GROUND AS DIRECTED BY ONSITE ENGINEER.
2. AS A GENERAL RULE, PLACE BASAL ENDS OF THE CUTTINGS 6 IN INTO THE CAPILLARY FRINGE OR SEASONAL SATURATED ZONE AS DIRECTED BY ONSITE ENGINEER.
3. PLACE SOIL FILL, FERTILIZER AND MYCRORHYZAE AROUND CUTTINGS AND 'WATER IN' IF POSSIBLE AS DIRECTED BY ONSITE ENGINEER.
4. CONSTRUCT GRANLUAR FILTER AND ROCK RIPRAP AS SHOWN IN PLANS AND AS DIRECTED BY ONSITE ENGINEER. DO NOT DAMAGE WILLOW POLES DURING ROCK PLACEMENT.
5. VADOSE ZONE, CAPILLARY FRINGE, AND SEASONAL SATURATION ZONE TO BE LOCATED BY ONSITE ENGINEER.

SOURCE: SALIX EARTHCARE INC.

VEGETATED RIPRAP
BENT POLE METHOD (HORIZONTAL)

DETAIL E
SCALE: NTS –



NOTES:
1. INTEGRATE WILLOW BUNDLE METHOD DURING ROCK PLACEMENT TO ENSURE CONTACT WITH NATIVE GROUND AS DIRECTED BY ONSITE ENGINEER.
2. BEND INDIVIDUAL POLES UP THROUGH THE RIPRAP DURING PLACEMENT WHILE ENSURING CONTACT OF THE STEM WITH NATIVE GROUND AS DIRECTED BY ONSITE ENGINEER.
3. PLACE SOIL FILL, FERTILIZER AND MYCRORHYZAE AROUND CUTTINGS AND 'WATER IN' IF POSSIBLE AS DIRECTED BY ONSITE ENGINEER.
4. CONSTRUCT GRANLUAR FILTER AND ROCK RIPRAP AS SHOWN IN PLANS AND AS DIRECTED BY ONSITE ENGINEER. DO NOT DAMAGE WILLOW POLES DURING ROCK PLACEMENT.
5. VADOSE ZONE, CAPILLARY FRINGE, AND SEASONAL SATURATION ZONE TO BE LOCATED BY ONSITE ENGINEER.

SOURCE: SALIX EARTHCARE INC.

VEGETATED RIPRAP
WILLOW BUNDLE METHOD (HORIZONTAL)

DETAIL F
SCALE: NTS –

100% SUBMITTAL
ISSUED FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER BRIAN J. DOERING No. 48984 Exp. 9-30-09 CIVIL STATE OF CALIFORNIA

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SYMBOL	DESCRIPTION OF REVISION	DATE

DRAWN JSR
DESIGNED JSR/SRD
REVIEWED BJD

U.S. AIR FORCE
SPACE COMMAND
VANDENBERG AFB

PROJECT TITLE: SAN ANTONIO CREEK STREAM RESTORATION
DRAWING TITLE: TYPICAL DETAILS
SCALE: AS NOTED
DATE: 02/22/08

PROJECT # 09-112882
DRAWING # C502
9 OF 9 SHEET #

APPENDIX B

Air Quality Analysis

Appendix B. Air Quality Analysis

Construction data provided by 30 CES Engineering Flight were used to prepare this analysis. The procedures and equations used to calculate the air emissions are detailed below.

B.1 Technical Assumptions and Emission Calculation

B.1.1 Proposed Action

The Proposed Action, described in detail in the Environmental Assessment, would install and construct various restoration and erosion control measures along a 0.875-mile stretch of San Antonio Creek on Vandenberg Air Force Base (VAFB), between U.S. Highway 1 and the Lee Road Utility Bridge. Components to be constructed include in-stream-rock-riffle grade controls at seven sites, and bioengineering bank stabilization at three sites, which include longitudinal peak stone toe protection and floodplain terraces. The estimated project area encompasses approximately 149 acres, with approximately 3.8 acres of riparian habitat created, and an estimated disturbance area from construction equipment and activities of 40 acres. Construction activities would occur during calendar year 2008 and last for approximately 40 workdays.

Table B-1 presents equipment usages for the estimated reasonable daily worst-case scenario, including equipment size and load factors. Table B-2 shows the emissions factors used to estimate the emissions, and Tables B-3 and B-4 show the reasonable worst-case daily and total project emissions. Because implementation would occur in 2008, emissions were estimated using 2008 emission factors.

Sources of air emissions from projects included under the Proposed Action would include combustive and fugitive emissions. Combustive emission would come from construction equipment, employee commuting, and trucks. Fugitive emissions would come from equipment disturbing the construction site.

B.1.2 Combustive Emissions

For combustive emissions from construction equipment, the daily emissions were calculated by multiplying the equipment horsepower, the load factor, the emission factor, the number of equipment and the hours of operation for a day. Project emissions were calculated by multiplying the equipment horsepower, the load factor, the emission factor, the number of equipment, and the hours of operation during the project. As shown in Table B-1, the default horsepower and load factors from URBEMIS 2007 (Jones & Stokes Associates 2007) were used. Emission factors for the construction equipment, also from URBEMIS 2007 (Jones & Stokes Associates 2007), are shown in Table B-2.

Vehicular emissions from employee commuting and truck trips were estimated by multiplying the total number of trips per day, the distance traveled, and the emission factor. Project emissions were calculated by multiplying number of trips per day by the distance traveled by the number of

days in the Proposed Action by the emission factor. It was assumed the average, one-way employee commute is 20 miles, while trucks delivering materials, would travel various distances, ranging between 4 and 85 miles one way, within Santa Barbara County. Emission factors for commuting employees and trucks hauling materials were obtained from California Air Resources Board's EMFAC 2007 (v2.3) BURDEN model run by the South Coast Air Quality Management District. The emission factors for employee commuting and construction trucks are also shown in Table B-2.

B.1.3 Fugitive Dust

Equipment operating on construction sites would disturb soil and create fugitive dust. The proponent estimated that on any given day between 0.5 and 1.0 acre would be disturbed. For purposes of this analysis, the most conservative average day estimate of 1.0 acre was used. The reasonable worst case day was assumed to disturb three times the area of an average day.

Daily fugitive dust emissions were estimated by multiplying the total daily area disturbed by the hours of operation by the emission factor of 3.49 pounds of particulate matter 10 microns or less in diameter (PM_{10}) per acre per hour (Santa Barbara County Air Pollution Control District [SBCAPCD] 2007). The project emissions were estimated by multiplying daily emissions by the number of days for the Proposed Action. The 3.49 pounds per acre per hour emission factor includes a PM_{10} fraction 0.64, and a 50 percent reduction in PM_{10} from site watering.

Table B-1. Equipment usage for Proposed Action.

Emission Source	Fuel	Power Rating (HP)	Load Factor	Number	Daily Hours	# of Days
Excavator	Diesel	250	0.57	2	10	40
Loader	Diesel	167	0.54	1	10	40
Loader	Diesel	98	0.54	1	10	40
Chipper/Mulcher	Diesel	130	0.78	1	10	20
Water Truck	Diesel	250	0.57	2	10	40
Dump Truck (5 ton) [(a)]	Diesel	0.5	1	20	8	25
Dump Truck (30 ton) [(a)]	Diesel	4	1	4	8	25
Dump Truck (30 ton) [(a)]	Diesel	31	1	26	8	30
Dump Truck (30 ton) [(a)]	Diesel	85	1	74	8	30
Road Grader	Diesel	150	0.61	1	8	25
Dozer	Diesel	165	0.9	4	8	40
Compactor	Diesel	165	0.55	2	8	25
Forklift	Diesel	120	0.3	1	8	30
Crane	Diesel	225	0.43	1	8	30
Chainsaw	Gas	5	0.70	4	8	12
Crew truck [(a)]	Diesel	20	1	20	1	40
Fugitive Dust Worst-Case Day [(b)]		3.00			10	1
Fugitive Dust Average Day [(b)]		1.00			10	39

NOTES:
(a) Power Rating is the number of miles traveled in one-way trip, and Number is the number of one-way trips per day.
(b) Power Rating is acres disturbed per day.

Table B-2. Construction equipment emission factors.

Emission Source	Emission Factors (g/hp-hr)					Ref.	Category
	CO	NOx	PM_{10}	ROG	SOx		
Excavator	0.894	3.527	0.122	0.331	0.004	(1)	Excavators
Loader (4 yd^3)	1.822	3.460	0.196	0.434	0.004	(1)	Tractors/Loaders/Backhoe
Loader (1.5 yd^3)	2.240	3.937	0.360	0.655	0.004	(1)	Tractors/Loaders/Backhoes
Chipper/Mulcher	3.227	6.089	0.550	1.044	0.005	(1)	Crushing/Proc. Equipment
Water Truck	0.934	3.624	0.128	0.355	0.004	(1)	Water Trucks
Dump Truck (5 tons) [(a)]	0.013614	0.044580	0.002156	0.003516	0.000041	(2)	Heavy Heavy Duty Diesel Trucks
Dump Truck (30 tons) [(a)]	0.013614	0.044580	0.002156	0.003516	0.000041	(2)	Heavy Heavy Duty Diesel Trucks
Dump Truck (30 tons) [(a)]	0.013614	0.044580	0.002156	0.003516	0.000041	(2)	Heavy Heavy Duty Diesel Trucks
Dump Truck (30 tons) [(a)]	0.013614	0.044580	0.002156	0.003516	0.000041	(2)	Heavy Heavy Duty Diesel Trucks
Road Grader	2.096	4.816	0.439	2.044	0.004	(1)	Graders
Dozer	1.822	3.460	0.196	0.434	0.004	(1)	Tractors/Loaders/Backhoes
Compactor	1.869	3.957	0.211	0.487	0.004	(1)	Rollers
Forklift	1.257	2.208	0.218	0.393	0.002	(1)	Forklift
Crane	2.849	3.024	0.117	0.304	0.003	(1)	Cranes
Chainsaw	2.150	0.002	0.001	0.684	0.001	(3)	Chainsaws >4 Hp
Crew Trucks [(a)]	0.008263	0.000918	0.000087	0.000914	0.000011	(2)	Passenger Vehicles
Fugitive Dust [(b)]			3.490			(2)	SBCAPCD Form 24

SOURCES:
(1) URBEMIS 2007 Version 9.2, Appendix I - Construction Equipment Emission Factors, Year 2008
(2) EMFAC 2007 Version 2.3 On-Road Emission Factors, Year 2008
(3) SCAQMD CEQA Air Quality Handbook - Table A9-8-A
NOTES:
(a) Emission factors from EMFAC 2007 Version 2.3 are in lbs/mile
(b) Emission factor is controlled in units of lbs/acre-hr with PM_{10} fraction 0.64 and Control Efficiency of 50%.

Table B-3. Estimated daily emissions.

Emission Source	Daily Emissions (Lbs/day)				
	CO	**NOx**	**PM10**	**ROG**	**SOx**
Excavator	5.6171	22.1604	0.7665	2.0797	0.0251
Loader (4 yd^3)	3.6223	6.8788	0.3897	0.1440	0.0080
Loader (1.5 yd^3)	2.6133	4.5932	0.4200	0.1275	0.0047
Chipper/Mulcher	7.2138	13.6117	1.2295	0.3895	0.0112
Water Truck	5.8684	22.7698	0.8042	0.3722	0.0251
Dump Truck (5 tons)	0.1361	0.4458	0.0216	0.0352	0.0004
Dump Truck (30 tons)	0.2178	0.7133	0.0345	0.0563	0.0007
Dump Truck (30 tons)	10.9726	35.9316	1.7380	2.8337	0.0333
Dump Truck (30 tons)	85.6300	280.4093	13.5634	22.1143	0.2602
Road Grader	3.3824	7.7719	0.7084	0.5505	0.0065
Dozer	12.5130	23.7623	1.3461	0.4974	0.0275
Compactor	5.9828	12.6666	0.6754	0.2602	0.0128
Forklift	0.7981	1.4019	0.1384	0.0416	0.0013
Crane	4.8614	5.1600	0.1996	0.0866	0.0051
Chainsaw	0.5309	0.0005	0.0004	0.0282	0.0002
Crew Trucks	3.3051	0.3673	0.0348	0.3656	0.0043
Fugitive Dust Worst-Case Day			104.7000		
Total	***153.2652***	***438.6443***	***126.7706***	***29.9825***	***0.4263***

Table B-4. Estimated Proposed Action emissions.

Emission Source	Project Emissions (Lbs)				
	CO	NOx	PM10	ROG	SOx
Excavator	224.68	886.42	30.66	83.19	1.01
Loader (4 yd^3)	144.89	45.92	15.59	34.51	0.32
Loader (1.5 yd^3)	104.53	30.66	16.80	30.57	0.19
Chipper/Mulcher	144.28	45.43	24.59	46.68	0.22
Water Truck	234.74	152.00	32.17	89.22	1.01
Dump Truck (5 tons)	3.40	11.15	0.54	0.88	0.01
Dump Truck (10 tons)	5.45	17.83	0.86	1.41	0.02
Dump Truck (30 tons)	329.18	1,077.95	52.14	85.01	1.00
Dump Truck (30 tons)	2,568.90	8,412.28	406.90	663.43	7.80
Road Grader	84.56	32.43	17.71	82.46	0.16
Dozer	500.52	158.63	53.84	119.22	1.10
Compactor	149.57	52.85	16.89	38.97	0.32
Forklift	23.94	7.02	4.15	7.49	0.04
Crane	145.84	25.83	5.99	15.56	0.15
Chainsaw	6.37	0.00	0.00	2.03	0.00
Crew Trucks	132.20	14.69	1.39	14.62	0.17
Fugitive Dust			1,361.10		
Total (Lbs)	***4,803.06***	***10,971.08***	***2,041.33***	***1,315.25***	***13.52***
Total (Tons)	***2.40***	***5.49***	***1.02***	***0.66***	***0.01***

B.2 References

Jones & Stokes Associates. 2007. Software User's Guide: URBEMIS2007 for Windows Version 9.2. Emissions Estimation for Land Use Development Projects. November.

SBCAPCD. 2007. 2007 Clear Air Plan. Santa Barbara County's plan to maintain the federal 8-hour ozone standard and attain the state 1-hour ozone standard. August 2007.

APPENDIX C

Biological Resources

Appendix C. Biological Resources

Table C-1. Plant species documented within the survey area for the proposed creek restoration.

Scientific Name	**Common Name**	***Scientific Name***	**Common Name**
Amsinckia sp.	Fiddleneck	*Gnaphalium ramosissimum*	Pink everlasting
Artemisia californica	California sagebrush	*Heliotropium curassavicum*	Heliotrope
Artemisia douglasiana	Mugwort	*Heteromeles arbutifolia*	Toyon
*Asphodelus fistulosus**	Asphodel	*Heterotheca grandiflora*	Telegraph weed
*Atriplex semibaccata**	Australian saltbush	*Hirschfeldia incana**	Perennial mustard
*Avena barbata**	Slender wild oats	*Hordeum murinum**	Foxtail barely
Baccharis douglasii	Marsh baccharis	*Juncus patens*	Spreading rush
Baccharis pilularis	Coyote brush	*Lathyrus latifolius**	Sweet-pea
*Brassica nigra**	Black mustard	*Lepidium draba**	Heart-podded hoary cress
*Bromus diandrus**	Ripgut brome	*Leymus condensatus*	Giant wild-rye
*Bromus hordeaceus**	Soft-chess brome	*Leymus triticoides*	Beardless wild-rye
Calystegia macrostegia	Morning-glory	*Lobularia maritima**	Sweet alyssum
*Carduus pycnocephalus**	Italian thistle	*Lolium multiflorum**	Italian ryegrass
*Centaurea melitensis**	Tacolote	*Lotus scoparius*	Deerweed
Chenopodium californicum	California goosefoot	*Malva nicaeensis**	Mallow
*Cirsium vulgare**	Bull thistle	*Marah fabaceus*	Manroot
*Conium maculatum**	Poison hemlock	*Marrubium vulgare**	Horehound
*Conyza canadensis**	Common horseweed	*Medicago polymorpha**	Bur-clover
Croton californicus	Croton	*Melilotus* sp.*	Sweet-clover
*Cynodon dactylon**	Bermuda grass	*Mimulus aurantiacus*	Sticky monkeyflower
Deinandra increscens	Tarplant	*Nicotiana glauca**	Tree tobacco
*Digitaria sanguinalis**	Crabgrass	*Phalaris minor**	Phalaris
Distichlis spicata	Salt grass	*Picris echioides**	Bristly ox-tongue
*Ehrharta calycina**	Veldt grass	*Plantago coronopus**	Cutleaf plantain
Leymus condensatus	Giant wildrye	*Plantago lanceolata**	English plantain
Epilobium ciliatum	Willow-herb	*Quercus agrifolia*	Coast live oak
Ericameria ericoides	Mock heather	*Raphanus sativus**	Wild radish
Eriogonum parvifolium	Seacliff buckwheat	*Rorippa nasturtium-aquaticum*	Watercress
*Erodium botrys**	Storkbill filaree	*Rosa californica*	California rose
*Erodium cicutarium**	Redstem filaree	*Rubus ursinus*	California blackberry
*Foeniculum vulgare**	Fennel	*Rumex acetosella**	Sheep sorrel
Galium aparine	Common bedstraw	*Rumex crispus**	Curly dock
Galium porrigens	Climbing bedstraw	*Rumex salicifolius*	Willow dock
Gnaphalium stramineum	Annual everlasting	*Salix laevigata*	Red willow
Gnaphalium californicum	California everlasting	*Salix lasiolepis*	Arroyo willow
*Gnaphalium luteo-album**	Cudweed	*Salsola tragus**	Russian thistle

Scientific Name	**Common Name**	***Scientific Name***	**Common Name**
Sambucus mexicana	Blue elderberry	*Sonchus oleraceus**	Common sow-thistle
Sanicula crassicaulis	Common sanicle	*Spergularia bocconei**	Sand-spurry
Scirpus californicus	California tule	*Toxicodendron diversilobum*	Poison oak
Scrophularia californica	California figwort	*Typha* sp.	Cattail
*Silybum marianum**	milk thistle	*Urtica dioica*	Stinging nettle
Solanum douglasii	Black nightshade	*Urtica urens**	Dwarf nettle
Solanum xanti	Purple nightshade	*Verbena lasiostachys*	Vervain
*Sonchus asper**	Prickly sow-thistle	*Vulpia myuros**	Rattail fescue

* Non-native species

SOURCE: Plant surveys were performed by MSRS in February 2008.

Table C-2. Wildlife species within the survey area for the proposed creek restoration.

Scientific Name	**Common Name**	**Occurrence**	**Status(*)**
Fish			
Gasterosteus aculeatus williamsoni	Unarmored threespine stickleback	Observed	FE, CE
Eucyclogobius newberryi	Tidewater goby	Observed	FE
Amphibians			
Ensatina eschscholtzii	Monterey ensatina	Potential	
Aneides lugubris	Arboreal salamander	Potential	
Batrachoseps nigriventris	Black-bellied slender salamander	Potential	
Spea hammondii	Western spadefoot	Potential	CSC
Bufo boreas	Western toad	Potential	
Hyla regilla	Pacific treefrog	Observed	
Rana catesbeiana	Bullfrog	Observed	
Rana draytonii	California red-legged frog	Observed	FT, CSC
Reptiles			
Actinemys marmorata	Western pond turtle	Observed	CSC
Sceloporus occidentalis	Western fence lizard	Observed	
Uta stansburiana	Common side-blotched lizard	Potential	
Phrynosoma coronatum	Coast horned lizard	Potential	CSC
Eumeces skiltonianus	Western skink	Potential	
Anniella pulchra	California legless lizard	Potential	CSC
Elgaria multicarinata	Southern alligator lizard	Observed	
Coluber constrictor	Racer	Potential	
Masticophis lateralis	Chaparral whipsnake	Potential	
Lampropeltis getula	California kingsnake	Observed	
Pituophis catenifer	San Diego gophersnake	Observed	
Thamnophis sirtalis	Common gartersnake	Observed	
Thamnophis elegans	Western terrestrial gartersnake	Potential	
Crotalus helleri	Southern Pacific rattlesnake	Observed	
Birds			
Butorides virescens	Green heron	Observed	
Cathartes aura	Turkey vulture	Observed	
Accipiter cooperii	Cooper's hawk	Observed	
Buteo jamaicensis	Red-tailed hawk	Observed	
Falco sparverius	American kestrel	Observed	
Callipepla californica	California quail	Observed	
Charadrius vociferus	Killdeer	Observed	
Zenaida macroura	Mourning dove	Observed	
Geococcyx californianus	Greater roadrunner	Observed	
Tyto alba	Barn owl	Observed	

Scientific Name	Common Name	Occurrence	Status(*)
Calypte anna	Anna's hummingbird	Observed	
Selasphorus sasin	Allen's hummingbird	Observed	
Colaptes auratus	Northern flicker	Observed	
Picoides nuttallii	Nuttall's woodpecker	Observed	
Picoides pubescens	Downy woodpecker	Observed	
Picoides villosus	Hairy woodpecker	Observed	
Contopus sordidulus	Western wood-pewee	Observed	
Empidonax difficilis	Pacific-slope flycatcher	Observed	
Sayornis nigricans	Black phoebe	Observed	
Myiarchus cinerascens	Ash-throated flycatcher	Observed	
Vireo huttoni	Hutton's vireo	Observed	
Vireo gilvus	Warbling vireo	Observed	
Aphelocoma californica	Western scrub-jay	Observed	
Corvus brachyrhynchos	American crow	Observed	
Corvus corax	Common raven	Observed	
Tachycineta bicolor	Tree swallow	Observed	
Petrochelidon pyrrhonota	Cliff swallow	Observed	
Stelgidopteryx serripennis	Northern rough-winged swallow	Observed	
Hirundo rustica	Barn swallow	Observed	
Chamaea fasciata	Wrentit	Observed	
Baeolophus inornatus	Oak titmouse	Observed	
Poecile rufescens	Chestnut-backed chickadee	Observed	
Psaltriparus minimus	Bushtit	Observed	
Troglodytes aedon	House wren	Observed	
Thryomanes bewickii	Bewick's wren	Observed	
Sialia mexicana	Western bluebird	Observed	
Catharus ustulatus	Swainson's thrush	Observed	
Catharus guttatus	Hermit thrush	Observed	
Turdus migratorius	American robin	Observed	
Toxostoma redivivum	California thrasher	Observed	
Sturnus vulgaris	European starling	Observed	
Vermivora celata	Orange-crowned warbler	Observed	
Dendroica coronata	Yellow-rumped warbler	Observed	
Dendroica petechia	Yellow warbler	Observed	CSC
Wilsonia pusilla	Wilson's warbler	Observed	
Geothlypis trichas	Common yellowthroat	Observed	
Icteria virens	Yellow-breasted chat	Observed	CSC
Pipilo crissalis	California towhee	Observed	
Pipilo maculatus	Spotted towhee	Observed	
Chondestes grammacus	Lark sparrow	Observed	

Scientific Name	Common Name	Occurrence	Status(*)
Ammodramus savannarum	Grasshopper sparrow	Observed	
Melospiza melodia	Song sparrow	Observed	
Zonotrichia leucophrys	White-crowned sparrow	Observed	
Pheucticus melanocephalus	Black-headed grosbeak	Observed	
Guiraca caerulea	Blue grosbeak	Observed	
Passerina amoena	Lazuli bunting	Observed	
Sturnella neglecta	Western meadowlark	Observed	
Agelaius phoeniceus	Red-winged blackbird	Observed	
Molothrus ater	Brown-headed cowbird	Observed	
Icterus bullockii	Bullock's oriole	Observed	
Carpodacus purpureus	Purple finch	Observed	
Carpodacus mexicanus	House finch	Observed	
Carduelis tristis	American goldfinch	Observed	
Carduelis psaltria	Lesser goldfinch	Observed	
Mammals			
Didelphis virginiana	Virginia opossum	Observed	
Sorex trowbridgii	Trowbridge's shrew	Potential	
Sorex ornatus	Ornate shrew	Potential	
Scapanus latimanus	Broad-footed mole	Observed	
Myotis yumanensis	Yuma myotis	Potential	
Myotis evotis	Long-eared myotis	Potential	
Myotis thysanodes	Fringed myotis	Potential	
Myotis volans	Long-legged myotis	Potential	
Myotis californicus	California myotis	Potential	
Myotis ciliolabrum	Small-footed myotis	Potential	
Lasionycteris noctivagans	Silver-haired bat	Potential	
Pipistrellus hesperus	Western pipistrelle	Potential	
Eptesicus fuscus	Big brown bat	Potential	
Lasiurus blossevillii	Western red bat	Potential	CSC
Lasiurus cinereus	Hoary bat	Potential	CSC
Corynorhinus townsendii	Townsend's big-eared bat	Potential	CSC
Antrozous pallidus	Pallid bat	Potential	CSC
Tadarida brasiliensis	Mexican free-tailed bat	Potential	
Eumops perotis	Western mastiff bat	Potential	CSC
Sylvilagus bachmani	Brush rabbit	Observed	
Lepus californicus	Black-tailed jackrabbit	Potential	
Spermophilus beecheyi	California ground squirrel	Observed	
Thomomys bottae	Botta's pocket gopher	Observed	
Dipodomys agilis	Pacific kangaroo rat	Potential	
Dipodomys heermanni	Heermann's kangaroo rat	Potential	

Scientific Name	Common Name	Occurrence	Status(*)
Chaetodipus californicus	California pocket mouse	Potential	
Castor canadensis	American beaver	Observed	
Microtus californicus	California vole	Potential	
Peromyscus maniculatus	Deer mouse	Potential	
Peromyscus boylii	Brush mouse	Potential	
Peromyscus californicus	California mouse	Potential	
Reithrodontomys megalotis	Harvest mouse	Potential	
Neotoma fuscipes	Dusky-footed woodrat	Observed	
Urocyon cinereoargenteus	Gray fox	Potential	
Canis latrans	Coyote	Observed	
Felis concolor	Mountain lion	Observed	
Procyon lotor	Racoon	Observed	
Mustela frenata	Long-tailed weasel	Potential	
Spilogale gracilis	Western spotted skunk	Observed	
Mephitis mephitis	Striped skunk	Observed	
Lynx rufus	Bobcat	Potential	
Sus scrofa	Wild pig	Potential	
Odocoileus hemionus	Mule deer	Observed	

FE= Federally Endangered FT= Federally Threatened CE= California Endangered Species CSC= California Species of Concern

SOURCES: Wildlife surveys were performed by MSRS in 2008 within the proposed restoration area. Sources used to determine potential occurrence include UCSB unpublished avian point count data from 2002 and 2004, and MSRS unpublished data from Barka Slough in 2004 and 2005.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
2008-F-0512

July 29, 2008

Beatrice L. Kephart
30 CES/CEV
1028 Iceland Avenue
Vandenberg Air Force Base, California 93437-6010

Subject: Biological Opinion for the Restoration of San Antonio Creek on Vandenberg Air Force Base, Santa Barbara County, California (1-8-08-F-9)

Dear Ms. Kephart:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the U.S. Air Force's (Air Force) proposed San Antonio Creek Restoration project on Vandenberg Air Force Base (VAFB) and its effects on the federally endangered El Segundo blue butterfly (*Euphilotes battoides allyni*) and unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), and the threatened California red-legged frog (*Rana aurora draytonii*). We received your request, dated March 18, 2008, in our office on March 19, 2008. Your request and our response are in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act)(16 U.S.C. 1531 et seq.).

You determined that the proposed restoration project may affect, but is not likely to adversely affect, the El Segundo blue butterfly and the federally endangered Gaviota tarplant (*Dienandra increscens* spp. *villosa*). We note that coast buckwheat (*Eriogonum parvifolium*) occurs within the proposed project area and represents potential habitat for the El Segundo blue butterfly. The proposed project has the potential to damage or destroy coast buckwheat plants, and without survey data or other information indicating whether these plants are occupied by El Segundo blue butterflies, we cannot determine that the proposed project is not likely to adversely affect the subspecies. If the coast buckwheat plants are occupied by the subspecies and are damaged or destroyed, El Segundo blue butterfly adults and (or) larvae could be adversely affected. Therefore, we do not concur with your determination that the proposed project may affect, but is not likely to adversely affect, the El Segundo blue butterfly.

Approximately 100 individual Gaviota tarplants occur within an approximate 1,600-square-foot patch of the proposed project area. The occupied patch is located near an existing staging area and the Air Force will flag and avoid the individual plants; therefore, the plants may only be affected by dust generated from the construction activities. Because the Air Force will flag and avoid all Gaviota tarplants within the project area, we concur with your determination that the proposed project may affect, but is not likely to adversely affect, the Gaviota tarplant.

This biological opinion was prepared using information provided in your request for formal consultation, electronic and telephone communications between our staffs, and information in our files. A complete administrative record for this biological opinion is available at the Ventura Fish and Wildlife Office.

CONSULTATION HISTORY

We conducted an emergency consultation with the Air Force because storm flows in February 1998 resulted in erosion damage within San Antonio Creek, between U.S. Highway 1 and the Lee Road utility bridge. The Air Force conducted emergency repairs in late February and early March 1998 at three sites (San Antonio Road West, Lee Road utility bridge, and Sheridan Road) because the erosion damage was threatening to undermine roadways, a bridge structure, and utility lines.

San Antonio Road West runs along the south side of San Antonio Creek and provides critical access to North VAFB facilities. The 1998 storm caused the creek channel to cut toward San Antonio Road West, which closed the road to traffic until the bank was stabilized. The Air Force placed approximately 5,000 tons of concrete rubble along 70 feet of the southern stream bank at this location. At the Lee Road utility bridge, the storm flows caused erosion under the bridge and approximately 250 feet upstream. The Air Force placed stone on 125 feet of the south creek bank upstream and on 60 feet of the north creek bank downstream of the bridge. A total of approximately 2,000 tons of stone was used. Sheridan Road crosses a tributary to San Antonio Creek; this crossing was an earthen fill structure that contained a corrugated metal pipe, two water lines, a communication cable conduit, and an instrumentation cable. The storm flows washed out Sheridan Road, thereby suspending the two water lines and breaking the communication cable conduit and instrumentation cable line. Subsequently, the Air Force excavated the area and repaired the crossing by constructing a reinforced concrete roadway over the tributary. The Air Force concluded that the emergency erosion repairs are likely to have adversely affected individuals of California red-legged frog and unarmored threespine stickleback and their associated habitats. To date, the Air Force has not requested to formal consultation on the adverse effects of the emergency repairs.

On May 30, 2007, we participated in a 30 percent design review meeting for the San Antonio Creek restoration project. This initial meeting included a site visit to two of the areas that were eroded by the 1998 storm flows and a discussion of the proposed restoration activities within the eroded stretch of the creek.

On April 9, 2008, we submitted a letter to the Air Force requesting more information prior to initiating formal consultation on the proposed project. Specifically, we requested more information concerning the status of the unarmored threespine stickleback and California red-legged frog within the project area. The Air Force submitted the information via electronic mail on April 19, 2008.

On April 10, 2008, we submitted questions and comments to VAFB via electronic mail concerning the proposed restoration project plan. On May 2, 2008, we met with VAFB staff to discuss these questions and comments. The Air Force responded to our questions via electronic mail on May 27, 2008. Additionally, on June 6, 2008, we discussed the amount of Gaviota tarplant that occurs within the proposed project area because the biological assessment stated that 45 acres of suitable habitat existed within the proposed project area; the Air Force subsequently determined that 1,600 square feet of occupied Gaviota tarplant habitat occurs within the proposed project area. The Air Force submitted a revised amount of Gaviota tarplant habitat via electronic mail on June 6, 2008 (L. Lum, VAFB botanist, pers. comm. 2008).

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

VAFB proposes to restore a section of San Antonio Creek because the Air Force determined that the emergency repairs conducted in 1998 are not adequate to provide long-term protection against further bank erosion. The eventual collapse of several creek embankments near U.S. Highway 1 would cause failure of San Antonio Road West and the Lee Road utility bridge and sever vital transportation and utility links to North VAFB. This would cause considerable delays and loss of productivity of North VAFB personnel and incur additional costs for permitting and transporting hazardous cargoes. Therefore, the Air Force proposes to restore 0.875 mile of San Antonio Creek between U.S. Highway 1 and the Lee Road utility bridge to protect the creek banks from erosion and potential failure, and to maintain a desired streambed elevation to reduce the potential for channel erosion and promote channel stability.

This restoration project would consist of constructing two integrated components within San Antonio Creek: (1) in-stream rock-riffle grade controls at seven sites to prevent aggressive bed degradation and arrest existing head cuts from continuing upstream; and (2) bioengineered bank stabilization at three of the grade control sites, including longitudinal peak stone toe protection and floodplain terraces. The terraces would reduce the pressure on the southern creek bank, which is highly susceptible to erosion. The Air Force would begin construction activities on August 25, 2008; however, the week before these activities commence, exclusion fencing would be installed and preconstruction surveys would begin. The Air Force expects to complete the project within 10 weeks.

The specific objectives of the restoration project are to:

a. Protect local infrastructure;
b. Provide grade stabilization and prevent further channel degradation;
c. Prevent migration of channel bottom head cuts through the restoration area;
d. Reduce the potential for undermining the Lee Road utility bridge structure;
e. Increase flow area at bends within the restored area, to decrease water velocity and shear stress during flood events;

f. Restore historical flood terraces within the restoration area to provide a diversity of habitat;
g. Increase the quality of suitable habitat within the restoration area for the unarmored threespine stickleback, California red-legged frog, and other wildlife species;
h. Stabilize the creek bank in key areas; and
i. Reduce erosion and the quantity of sediment delivered to downstream wetlands.

To complete the restoration project, the Air Force would construct 10 temporary access roads to deliver the materials and equipment to the work sites; material staging areas would be located adjacent to the access roads. An existing graded area on the westbound shoulder of U.S. Highway 1 would also be used for staging equipment and materials. Existing vegetation would be removed mechanically and processed into mulch for use within the project area. Larger vegetation located within sensitive cultural resource areas would be hand cleared. When required, the Air Force would grade and compact the access roads and staging areas and place geotextile fabric and a 6- to 8-inch layer of small-diameter rocks on top to increase stability. These materials would be removed upon completion of the project. The excavated soil would be used as fill within the project sites.

The Air Force would divert the active creek channel around the work sites to allow the construction activities to occur within the creek banks and ensure unimpeded flow. The Air Force will install 4- to 6-inch plastic pipes to allow the active flows to pass through or around the project area, including velocity dissipation at the outfall. Screens (no larger than 0.25-inch mesh) would be installed at each end of each pipe to prevent California red-legged frogs and unarmored threespine sticklebacks from becoming trapped within the pipes. In addition, the pipes would be checked daily to ensure that they do not become blocked by debris. These diversion pipes would remain operational until all activities are completed, approximately 3 to 7 days per site. The diversion pipes would then be capped off and buried in place upon the completion of construction activities.

Grade controls would be installed at seven locations in San Antonio Creek from just below the U.S. Highway 1-San Antonio Road West intersection to just below the Lee Road utility bridge. The locations and elevations of these structures were selected based upon the anticipated channel profile and because they would tie into the bank stabilization sites. Non-woven geotextile fabric and a 6-inch layer of rock bedding would be placed within the footprint of each grade control structure to prevent it from settling and becoming ineffective. Rock would be placed so that each grade control structure's crest would not be greater than 4 feet higher than the existing creek bed. As sediment is trapped behind these structures, the creek bed is expected to become level with the crest. The rock would be spaced to create a low flow fish passage and form pools upstream of the crest to provide habitat with low flow conditions. Rock keys would be constructed at the upstream end of each grade control structure into the existing bank and up to the 100-year flood level. This would prevent potential flanking of the structures during peak runoff events. Pole plantings would be installed at the toe of the slope and upstream of the rock keys. Sand and gravel would be used to fill in the voids in the rock rip-rap.

Biotechnical plantings would be incorporated into the project sites to provide geotechnical strength, decrease erosion susceptibility, improve habitat, and enhance aesthetics. Willow (*Salix* spp.), which is the dominant riparian tree species within the project area and will propagate rapidly from cuttings, along with other plant species native to the San Antonio Creek watershed, would be used for biotechnical stabilization and bioengineering. Live branch cuttings (predominantly willow) would be separated into branches and poles. Branch cuttings would be used for live siltation and horizontal brush layering techniques, arrayed depending on their desired function. Poles would be used to vegetate rock rip-rap. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), red willow (*S. laevigata*), arroyo willow (*S. lasiolepis*), shining willow (*S. lucida* ssp. *lasiandra*), and blue elderberry (*Sambucus mexicana*) are native species that would be used for pole plantings. The cuttings would be collected from specimens within the project area; however, if additional cuttings are required, the Air Force would collect cuttings from within 30 acres of willow riparian habitat near the El Rancho Lateral Road-Lompoc Casmalia Road intersection. The Air Force would conservatively collect the branches so the parent plant is not compromised.

Areas disturbed by the construction activities would be restored to an ecologically functional state that supports the same local plant and animal species found within adjacent natural areas. By using site-specific native species, the Air Force expects that the established vegetation would require little to no long-term maintenance. Additionally, the Air Force would apply a standard treatment to disturbed soils above the ordinary high water mark of San Antonio Creek, including soil preparation, soil amendments, and a seed mix. The seed mixes, applied by hand, would account for species variation within different vegetation types, with a combination of shrub, perennial, and annual species. In addition, the native topsoil and subsoil would be salvaged during the excavation and grading activities because it is expected to contain a native seed bank. Soil in areas with a seed bank that is dominated by weedy species would not be salvaged.

Bank Stabilization Site 1

Site 1 is located immediately west of the U.S. Highway 1-San Antonio Road West intersection. San Antonio Creek has eroded to a near vertical slope at this site. The proposed construction activities at Site 1 are designed to provide 100-year flood protection for the south bank of San Antonio Creek. The height of the slope is approximately 85 feet between the road surface and the streambed. The Air Force proposes to install a "living dike system" to redirect the creek thalweg, vegetated rip-rap, a vegetated longitudinal peak stone toe, and create a floodplain terrace. The increased cross-sectional area, and the cover and geotechnical strength provided by the biotechnical plantings, would reduce creek bank erosion, improve natural stream function, and enhance riparian habitat. Access to Site 1 would occur from three designated access routes originating from U.S. Highway 1, San Antonio Road West, and Sheridan Road.

The Air Force would construct a living dike system to redirect the creek thalweg away from the current alignment and into a new low-flow channel. The living dike would consist of three trenches with willow pole plantings in each; the trenches would be backfilled with excavated soil. This channel would realign approximately 600 feet of San Antonio Creek north of the

eroded south creek bank. The north creek bank would be excavated to create a floodplain terrace at the 2- and 5-year flood elevations. Above the 5-year terrace, a slope would be excavated to the top of the embankment. A slope would also be graded between the low flow channel and the living dike system.

A 500-foot stone toe, using 0.5-ton rock, would be constructed along the realigned south creek bank to protect against bend scour. The downstream end of the stone toe would connect to a grade control structure to provide long-term scour protection. Longitudinal peak stone toe protection would be installed approximately 280 feet upstream of the stone toe on the south creek bank. The rock would be placed on a granular filter following the old creek bed alignment. Additionally, the soil embankment would be excavated to key in four stone tie-back structures into the creek bank. The area between the south creek bank and the longitudinal peak stone toe protection would be backfilled with rip-rap. Rock rip-rap would be keyed into the creek bank at the upstream and downstream ends.

The Air Force would also grade the top of the existing embankment at a 2 percent minimum grade and excavate soil from the top of the existing slope. Compacted fill material excavated from the project site would be used to rebuild approximately 500 feet of the south creek bank above the stone toe. The bank would be armored with vegetated rip-rap up to the 100-year flood level.

Live siltation, consisting of willow branches placed in the soil at the toe of the slope and angling toward the creek, would add strength to the stone toe, trap sediment, increase bank roughness, and provide cover and riparian habitat. In addition, pole plantings would be installed behind the rip-rap protection utilizing the bent pole method[1]. Once established, root systems of these trees would help provide bank stabilization and establish vegetative growth within the rock. Rock would be soil filled and the area would be revegetated.

The Air Force also proposes to modify the existing metal beam guard railing located on the westbound shoulder of San Antonio Road West by extended the railing 170 feet at the west end and 70 feet at the east end. Each wood post would cover 1 square foot on the road shoulder.

Bank Stabilization Site 2

Site 2 is located adjacent to the westbound shoulder of San Antonio Road West, approximately 2,000 feet west of U.S. Highway 1. Concrete rubble and rebar currently armor approximately 120 feet of the south creek bank. A concrete ditch located on the eastbound shoulder of San Antonio Road West and a cross culvert discharge onto this section of the creek bank. The height of the bank at this site is approximately 35 feet between the road surface and the streambed.

The proposed construction activities at Site 2 are designed to stabilize the existing slope and improve the function of the north creek bank. The improvements consist of a vegetated stone

[1] Poles would be laid on the bank extending below the seasonal saturation zone with the tips bent to a vertical position through the rock rip-rap, creating a dense and continuous vegetative cover.

toe, a vegetated mechanically-stabilized earth fill slope, a floodplain terrace, and a rock swale for the existing pipe outfall. Access to Site 2 would occur from two access roads originating from San Antonio Road West.

A longitudinal peak stone toe would be constructed along approximately 410 feet of the south creek bank below the existing concrete rubble and the adjacent upstream creek bank. The stone toe protection will prevent erosion where the creek flow directly impinges on the bank and stop migration of the creek. The Air Force would excavate soil on the south creek bank up to the two-year flood elevation to place the rock rip-rap. The stone toe would be keyed in upstream to the 5-year and 100-year flood levels to prevent flanking of the rip-rap. The downstream end would be tied into a rock riffle grade control structure, providing general scour protection. Live siltation would add strength to the stone toe, trap sediment, and enhance riparian habitat.

Protruding rebar and concrete rubble that exists on the south creek bank would be trimmed, choked with sand, and protected in place. Approximately 300 feet of the south creek bank would be rebuilt with fill material excavated from the project site. Live willow branches would be layered in lifts within the soil as the slope is constructed up to the 100-year flood elevation. The area above the soil lifts would be revegetated. Coir netting would act as an erosion control blanket until the vegetation is established.

A rock swale would carry surface flows from an existing 30-inch diameter pipe, installed beneath San Antonio Road West, down the south embankment and to the stone toe. Large diameter rock would be embedded into the vegetated, mechanically stabilized bank to create a rock swale approximately 16 feet wide and 75 feet long.

Approximately 200 feet of San Antonio Creek would be shifted 25 feet north, away from the eroded south bank, and an approximate 160-foot long low flow channel would be excavated. In addition, the north creek bank would be excavated to create a floodplain terrace at the 2-year flood elevation, with a slope above the terrace up to the 100-year flood elevation. This area would be revegetated.

The Air Force would install a metal guard railing, approximately 270 feet long, on the westbound shoulder of San Antonio Road West. Each wood post would cover 1 square foot on the road shoulder.

Bank Stabilization Site 3

Site 3 is located where the Lee Road utility bridge crosses San Antonio Creek, approximately 1,400 feet downstream from Site 2. Along the northern bridge abutment, the creek is armored with gabion baskets and mattresses; the southern abutment is protected with rock rip-rap. The creek banks at Site 3 are approximately 30 feet high between the road surface and the streambed.

The improvements at Site 3 are designed to prevent flanking of the existing rock rip-rap along the southern bridge abutment. The Air Force would install a vegetated longitudinal peak stone

toe with live siltation, and grade a new low-flow channel and floodplain terrace. The north creek bank would be excavated to create the floodplain terrace at the 2-year flood elevation, with a slope above the terrace up to the 5-year level. In addition, rock rip-rap that has fallen into the creek channel would be removed and incorporated as part of the stone toe. Access to Site 3 is restricted to two designated access roads originating from Lee Road and Sheridan Road.

The Air Force would excavate soil and install rock rip-rap along 150 feet of the south creek bank at the toe of the slope. A geotextile fabric and rock bedding placed below the rock keys would help stabilize the rip-rap. The stone toe would be keyed in to the 5-year flood elevation at the upstream end to prevent flanking of the rock. The downstream end of the stone toe would be keyed into the creek bank and tied into the existing rock rip-rap. The stone toe would provide a more stable transition to the existing rip-rap on the south creek bank. In addition, a grade control structure would be located downstream of the Lee Road utility bridge and would tie into the existing rock rip-rap and gabion protection to provide long term scour protection at this site. Furthermore, live siltation would be integrated to add strength to the toe, trap sediment, and enhance riparian habitat.

Post-construction Monitoring

The Air Force would conduct post-construction monitoring to assess the effectiveness of the initial revegetation efforts and provide guidance for follow-up maintenance. The post-construction monitoring would focus on the extent of native species cover and the diversity and presence of non-native, invasive plant species. The Air Force anticipates that eradication of invasive plants would be necessary throughout the 5-year monitoring period. Therefore, they would assess the project area on a monthly basis for watering needs and for the presence of non-native, invasive plant species.

Avoidance and Minimization Measures

The Air Force proposes to implement the following measures to avoid and minimize the potential adverse effects of the proposed construction activities on the California red-legged frog, El Segundo blue butterfly, and unarmored threespine stickleback.

1. Qualified biologists will brief all project personnel prior to participating in construction activities. At a minimum, the briefing will include a description of the project components and techniques, a description of the listed species occurring in the project area, and the general and specific measures and restrictions to protect the species during implementation of the project;

2. All hazardous materials required to operate and maintain construction equipment will be properly used in accordance with manufacturer's specifications;

3. The contractor will follow an approved spill prevention plan, including procedures to ensure that all equipment is properly maintained and free of leaks and all necessary

repairs incorporate proper spill containment. The plan will be submitted to the VAFB environmental office (30 CES/CEV) for approval;

4. Hazardous materials will be properly stored and managed in secured areas located outside of the San Antonio Creek riparian corridor;

5. All equipment and holding tanks will be staged, repaired, and maintained at least 500 feet outside the San Antonio Creek riparian corridor. Fueling of equipment will be conducted in pre-designated areas. Spill containment materials will be placed around the equipment before refueling;

6. If refueling of equipment within the creek bed or riparian corridor is necessary, the Air Force will implement safety measures, such as temporary catch pans or basins, to catch accidental overflow;

7. Equipment operating from the creek banks will be restricted to the access roads whenever possible. The time that equipment is operated outside of the access roads will be minimized to the extent possible. Stationary equipment operating within the creek bed will be placed on protective mats to prevent contamination of the creek bed;

8. A qualified biologist will be present if it is necessary to refuel or repair project equipment within the creek bed or the riparian corridor,

9. All temporary disturbed areas, including the access roads, will be restored (at a minimum) to the original condition;

10. Temporary containment of the active creek channel will occur through or around a project site to ensure unimpeded flow through the project area;

11. California red-legged frogs captured during surveys or construction activities will be relocated to the nearest suitable habitat outside of the project area;

12. Prior to containment of the creek channel, a qualified biologist will install exclusion nets and drift fencing to exclude the unarmored threespine stickleback, California red-legged frog, and other aquatic species from the project sites;

13. Exclusion nets will be set up within the main channel of San Antonio Creek approximately 50 feet upstream and downstream of a project site. Silt fencing or another similar material will be used to construct the exclusion nets;

14. The exclusion nets will be checked daily to remove debris and ensure good working condition;

15. One week before instream construction activities begin, and after the exclusion nets are installed, the Air Force will conduct at least three survey efforts to capture and relocate unarmored threespine sticklebacks and California red-legged frogs out of the work areas. The last of these surveys would occur within 2 days of the start of construction;

16. Each day, Service-approved biologists will conduct surveys of the work sites prior to the start of construction activities;

17. Capturing and relocating adult and sub-adult California red-legged frogs would be conducted between 1 hour after sunset and midnight when they are most active. All areas within the exclusion zones will be surveyed for sensitive species;

18. Dipnets will be used to capture any California red-legged frog tadpoles within work areas;

19. Dewatering pumps will include a screen (no larger than 0.125-inch mesh) to prevent entrapment of unarmored threespine sticklebacks or California red-legged frogs;

20. A qualified biologist will monitor unarmored threespine sticklebacks downstream of the project area before and periodically during the construction activities to assess downstream impacts;

21. Water quality parameters will be measured prior to the commencement of the project in a manner that minimizes adverse impacts to the unarmored threespine stickleback and California red-legged frog;

22. A contingency plan will be developed for the recovery and salvage of unarmored threespine sticklebacks and California red-legged frogs in the event of a local toxic spill or accidental dewatering of their respective habitats; and

23. Service-approved biologists will permanently remove any individuals of non-native species such as bullfrogs (*Rana catesbeiana*), crayfish (e.g., signal crayfish *Pastifasticus leniusculus* and red swamp crayfish (*Procambarus clarki*)), and centrarchid fishes to the maximum extent possible.

STATUS OF THE SPECIES

California Red-legged Frog

The California red-legged frog was federally listed as threatened on May 23, 1996 (Service 1996) and critical habitat was designated for the subspecies on April 13, 2006 (Service 2006). The Service completed a recovery plan for the subspecies in 2002 (Service 2002).

The California red-legged frog uses a variety of habitat types, including various aquatic systems, riparian, and upland habitats. The diet of California red-legged frogs is highly variable. Tadpoles probably eat algae (Jennings et al. 1992). Hayes and Tennant (1985) found invertebrates to be the most common food item of adults. Vertebrates, such as Pacific chorus frogs (*Pseudacris regilla*) and California mice (*Peromyscus californicus*), represented over half of the prey mass eaten by larger frogs (Hayes and Tennant 1985). Feeding activity probably occurs along the shoreline and on the surface of the water. Hayes and Tennant (1985) found juveniles to be active diurnally and nocturnally, whereas adults were largely nocturnal.

California red-legged frogs breed from November through March; earlier breeding has been recorded in southern localities (Storer 1925). Males appear at breeding sites from 2 to 4 weeks before females (Storer 1925). Female California red-legged frogs deposit egg masses on emergent vegetation so that the masses float on the surface of the water (Hayes and Miyamoto 1984). Egg masses contain about 2,000 to 5,000 moderately-sized, dark reddish brown eggs (Storer 1925, Jennings and Hayes 1985). Eggs hatch in 6 to 14 days (Storer 1925). Larvae undergo metamorphosis for 3.5 to 7 months after hatching (Storer 1925, Wright and Wright 1949). Sexual maturity can be attained at 2 years of age by males and 3 years of age by females (Jennings and Hayes 1985); adults may live 8 to 10 years (Jennings et al. 1992) although the average life span is considered to be much lower. The California red-legged frog is a relatively large aquatic frog ranging from 1.5 to 5 inches from the tip of the snout to the vent (Stebbins 1985).

California red-legged frogs breed in aquatic habitats. Larvae, juveniles, and adults have been collected from streams, creeks, ponds, marshes, plunge pools and backwaters of streams, dune ponds, lagoons, and estuaries. California red-legged frogs frequently breed in artificial impoundments such as stock ponds, if conditions are appropriate. Although California red-legged frogs successfully breed in streams and riparian systems, high seasonal flows and cold temperatures in streams often make these sites risky environments for eggs and tadpoles. The importance of riparian vegetation for this species is not well understood. When riparian vegetation is present, California red-legged frogs spend considerable time resting and feeding in it; the moisture and camouflage provided by the riparian plant community likely provide good foraging habitat and may facilitate dispersal in addition to providing pools and backwater aquatic areas for breeding.

Juvenile and adult California red-legged frogs may disperse long distances from breeding sites throughout the year. They can be encountered living within streams at distances exceeding 1.8 miles from the nearest breeding site, and have been found up to 400 feet from water in adjacent dense riparian vegetation (Bulger et. al 2003). During periods of wet weather, starting with the first rains of fall, some individuals may make overland excursions through upland habitats. Most of these overland movements occur at night. Bulger et al. (2003) found marked California red-legged frogs in Santa Cruz County making overland movements of up to 2 miles over the course of a wet season. These individual frogs were observed to make long-distance movements that are straight-line, point to point migrations over variable upland terrain rather than using riparian corridors for movement between habitats. For the California red-legged frog, suitable habitat is

considered to include all aquatic and riparian areas within the range of the species and includes any landscape features that provide cover and moisture (Service 1996).

The historic range of the California red-legged frog extended coastally from southern Mendocino County and inland from the vicinity of Redding, California, southward to northwestern Baja California, Mexico (Jennings and Hayes 1985, Storer 1925). The California red-legged frog has been extirpated or nearly extirpated from 70 percent of its former range. Historically, this subspecies was found throughout the Central Valley and Sierra Nevada foothills. Four additional occurrences have been recorded in the Sierra Nevada foothills since listing, bringing the total to 5 extant populations, compared to approximately 26 historical records (Service 2006). Currently, California red-legged frogs are known from 3 disjunct regions in 26 California counties and 1 region in Baja California, Mexico (Grismer 2002; Fidenci 2004; and R. Smith and D. Krofta, in litt. 2005).

California red-legged frogs have been found at elevations that range from sea level to about 5,000 feet. In the Sierra Nevada Mountains, California red-legged frogs typically occur below 4,000 feet in elevation (Service 2006).

Habitat loss and degradation, combined with over-exploitation and introduction of exotic predators, were important factors in the decline of the California red-legged frog in the early to mid-1900s. Continuing threats to the California red-legged frog include direct habitat loss due to stream alteration and loss of aquatic habitat, indirect effects of expanding urbanization, competition or predation from non-native species including the bullfrog, catfish (*Ictalurus* spp.), bass (*Micropterus* spp.), mosquitofish, red swamp crayfish, and signal crayfish. Chytrid fungus (*Batrachochytrium dendrobatidis*) is a waterborne fungus that can decimate amphibian populations, and is considered a threat to California red-legged frog populations.

El Segundo Blue Butterfly

The El Segundo blue butterfly was federally listed as endangered on June 1, 1976 (Service 1976). Critical habitat for the species has not been designated. We issued a recovery plan for the El Segundo blue butterfly on September 28, 1998 (Service 1998). The El Segundo blue butterfly was formally described by Oakley Shields (1975) based on specimens that had been collected in the city of El Segundo.

The El Segundo blue butterfly is in the family Lycaenidae. It is one of five subspecies comprising the polytypic species, the square-spotted blue butterfly *(Euphilotes battoides)*. These butterflies inhabit southern California, southern Nevada, Arizona, and northern Mexico. The El Segundo blue butterfly is presumed to be endemic to southwestern Los Angeles County in coastal southern California. The adults have a wingspan of 0.75 to 1.25 inches. The wings of males are a brilliant blue color with an orange border on the rear of the upper hindwings. The females have dull brown colored wings with an orange border on the upper distal surface of the hindwings (Service 1998).

Like all species in the genus *Euphilotes*, the El Segundo blue butterfly spends its entire life cycle in intimate association with a species of buckwheat, in this case coast buckwheat. However, the nearly complete association of all life stages with a single plant is unique among North American butterflies. El Segundo blue butterfly adults mate, nectar, lay eggs, perch, and in most cases probably die on flower heads (Mattoni 1990).

The adult stage of the El Segundo blue butterfly begins in early June and concludes in early to mid-September. The onset of this stage is closely synchronized with the beginning of the flowering season for coast buckwheat (Mattoni 1990). Typically, adult females survive up to 2 weeks whereas a male may survive up to 7 days (G. Pratt, Department of Entomology, University of California Riverside, pers. comm. 2006a). Upon emergence as adults, females fly to coast buckwheat flower heads where they mate with males that are constantly moving among flower heads (Service 1998). Eggs hatch within 3 to 5 days. The larvae then undergo four instars to complete growth, a process that takes 18 to 25 days (Service 1998). By the third instar, the larvae develop honey glands, and are thereafter usually tended by ants (e.g., *Iridiomyrmex humilis*, *Conomyrmex* spp.), which may protect them from parasitoids (e.g., Branchoid wasp (*Cortesia* spp.)) and small predators (Mattoni 1990). The larvae remain concealed within flower heads and initially feed on pollen, then switch to feeding on seeds sometime during the first and second instar (Pratt, pers. comm. 2006a). Larvae are highly polymorphic, varying from almost pure white or yellow to strikingly marked individuals with a dull red-to-maroon background broken by a series of yellow or white dashes (Mattoni 1990). By September, coast buckwheat plants have generally senesced and the larvae fall or crawl to the ground and diapause in the soil from September until they emerge as adults the following June. Some pupae may remain in diapause for 2 or more years (Service 1998). At least 0.5 inch of rain must penetrate the soil to accumulate enough moisture for the pupae to undergo a life stage change (Pratt, pers. comm. 2006a).

Historically, the El Segundo blue butterfly likely inhabited much of the El Segundo Dunes. Museum records reveal that the El Segundo blue butterfly was once widespread on the El Segundo sand dunes and specimens were collected at El Segundo, Redondo Beach, Manhattan Beach, and at several locations on the Palos Verdes peninsula (Donahue 1975). There are known populations at four locations in Los Angeles County: the Ballona Wetlands, the Airport Dunes, the Chevron Preserve, and Malaga Cove. Four recovery units, based on geographic proximity, habitat similarity, and possible genetic exchange, encompass these areas with the known populations and (or) areas with restorable habitat (Service 1998).

The precise habitat requirements of El Segundo blue butterflies are not fully understood. Because El Segundo blue butterflies depend solely on coast buckwheat, their distribution is dependent upon the occurrence of coast buckwheat. The range of coast buckwheat is greater than the known range of the El Segundo blue butterfly; coast buckwheat extends from San Diego County to the northern end of Monterey County (Pratt, pers. comm. 2006b). However, the southern extent of the El Segundo blue butterfly's known distribution is Malaga Cove in Los Angeles County; as of 2005, the northern extent of the subspecies' known distribution was the

Ballona Wetlands, which is also in Los Angeles County. The El Segundo blue butterfly appears further limited to areas with high sand content (Service 1998).

In general, the El Segundo blue butterfly is negatively impacted by competition with non-native vegetation, other insects utilizing coast buckwheat, and habitat fragmentation. Relatively fast-growing exotics such as acacia (*Acacia* spp.), iceplant (*Carprobrotus* spp.), other buckwheat species (*Eriogonum* spp.), and non-native grasses compete with coast buckwheat by inhibiting seedlings from sprouting and maturation of juveniles (Mattoni 1990). Habitat fragmentation produces edge effects that facilitate the introduction of invasive, non-native plant species that have the ability to out-compete and displace coast buckwheat.

El Segundo blue butterflies are also adversely affected by competition, predation, and parasitism by other insect species that utilize coast buckwheat flower heads. Pratt (1987) observed numerous insects living in coast buckwheat inflorescences along with El Segundo blue butterfly larvae, including lepidopterous larvae in the families of Cochylidae, Gelechiidae, Geometridae, Riodinidae, and even other Lycaenidae.

Habitat fragmentation is detrimental to small, isolated populations. Urbanization and land conversion have fragmented the historic range of the El Segundo blue butterfly such that extant populations now operate as independent units rather than parts of a metapopulation or a single, cohesive, wide-ranging population. Small populations have higher probabilities of extinction than larger populations because their low abundance renders them susceptible to inbreeding, loss of genetic variation, high variability in age and sex ratios, demographic stochasticity, and other random, naturally occurring events such as droughts or disease epidemics (Soulé 1987). Isolated populations are more susceptible to elimination by stochastic events because the likelihood of recolonization following such events is negatively correlated with the extent of isolation (Wilcox and Murphy 1985). Given the low dispersal potential of El Segundo blue butterflies, it is unlikely that this species will naturally recolonize a site.

Recently discovered population at VAFB

The El Segundo blue butterfly was recently reported to occur at VAFB in 2005 by Dr. Gordon Pratt and in 2007 by Dr. Pratt and Dr. Richard Arnold (Pratt, pers. comm. 2006a; L. Bell, Vandenberg Air Force Base biologist, pers. comm. 2007). However, it is not absolutely clear whether the individuals observed at VAFB are actually the El Segundo blue butterfly or morphologically similar species. Based on wing morphology, flight period, genitalia, and host plant association; these individuals were determined to be more similar to the El Segundo blue butterfly than to any other known *Euphilotes battoides* group taxon (G. Ballmer, Department of Entomology, University of California Riverside, pers. comm. 2006; Pratt, pers. comm. 2006c). Therefore, we consider this species to be the El Segundo blue butterfly until we receive definitive information demonstrating otherwise. Given the geographic separation between VAFB and the El Segundo Dunes (approximately 120 miles) and the relatively limited dispersal capability of El Segundo blue butterflies, it is possible that the butterflies observed at VAFB are not El Segundo blue butterflies but rather an undescribed species. Butterflies in the genus

Euphilotes can be very similar morphologically yet significantly different genetically (Mattoni 1990; Pratt 1994). Conversely, it is also possible that suitable habitat for the El Segundo blue butterfly was once contiguous from the El Segundo sand dunes to Santa Barbara County and has been displaced in some areas by development and other anthropogenic causes.

The uncertain taxonomic status of the populations that were recently discovered at VAFB makes it impossible to assess whether the current distribution of the El Segundo blue butterfly is different from the range previously stated. To conclusively determine the identity of these butterflies, VAFB has collected male individuals to compare the genetic signatures among the butterflies from VAFB with known El Segundo blue butterflies. However, clarifying the taxonomic status of these populations will not be trivial as *Euphilotes* is a diverse genus with known cryptic speciation (Mattoni 1988). Wing characters are notoriously unreliable due to individual variability, so single individuals usually cannot be confidently determined without other clues such as location, flight season, and larval host plant (Ballmer, pers. comm. 2006). Based on the most recent surveys in 2007, VAFB contains a tentative total of 17,470 potentially occupied acres, which was determined by buffering the known El Segundo blue butterfly localities by 1 mile (the approximate maximum dispersal distance of the subspecies).

Unarmored Threespine Stickleback

The unarmored threespine stickleback was federally listed as endangered in 1970 primarily due to competition with or predation by non-native fish, loss of habitat through urbanization and channelization, and introgression with other subspecies of sticklebacks (Service 1970). Critical habitat for the unarmored threespine stickleback was proposed in 1980 for two reaches of the Santa Clara River, and single reaches of both San Francisquito Creek and San Antonio Creek; designation of critical habitat remains pending (Service 1980). The unarmored threespine stickleback is a fully protected species under California law (see California Fish and Game Code, Section 5515 (b)(9)). The recovery plan for the unarmored threespine stickleback (Service 1985) provides additional information on the biology of the species, reasons for its decline, areas of essential habitat, and the actions needed for recovery of the species.

Unarmored threespine sticklebacks are small fish (up to 2.36 inches) inhabiting slow moving reaches or quiet water microhabitats of streams and rivers. Favorable habitats usually are shaded by dense and abundant vegetation. In more open reaches, algal mats or barriers may provide refuge for the species. Unarmored threespine sticklebacks feed primarily on benthic insects, small crustaceans, and snails, and to a lesser degree, on flat worms, nematodes, and terrestrial insects. Unarmored threespine sticklebacks reproduce throughout the year with a minimum of breeding activity occurring from October to January. Reproduction occurs in areas with adequate aquatic vegetation and gentle flow of water where males establish and vigorously defend territories. The male builds a nest of fine plant debris and algal strands and courts all females that enter his territory; a single nest may contain the eggs of several females. Following spawning, the males defend the nests and the newly hatched fry, which hatch after approximately 6 days. Unarmored threespine sticklebacks are believed to live for only 1 year (Service 1985).

Unarmored threespine sticklebacks historically were distributed throughout southern California but are now restricted to the upper Santa Clara River and its tributaries in Los Angeles and Ventura Counties, San Antonio Creek on VAFB in Santa Barbara County, Shay Creek (tributary to Baldwin Lake) in San Bernardino County, and San Felipe Creek in San Diego County. A population was transplanted into San Felipe Creek in the Salton Sea drainage and into Cañada Honda Creek on VAFB. Transplanted populations tend not to persist (Moyle 2002). In fact, no individuals have been observed in Cañada Honda Creek in 13 years (R. Evans, VAFB Natural Resource Manager, pers. comm. 2008).

Habitat degradation in the form of flood control and channelization are the primary threats to the survival of the unarmored threespine stickleback. Other forms of habitat degradation can occur when people or livestock trample stream banks, causing increased soil erosion and sedimentation in streams and breeding pools and reducing the availability of plants and insects that serve as habitat and food for the species. Damage to, or destruction of, the emergent vegetation along the stream banks also degrades the shallow, weedy nursery areas that provide abundant food and shelter for unarmored threespine stickleback.

Other threats to unarmored threespine stickleback often occur in popular riparian areas near campgrounds where humans dam pools for wading and inadvertently trample adjacent sand or gravel bars during streamside recreational activities. These activities force the unarmored threespine stickleback to constantly move away from human traffic or be driven into areas where they are more susceptible to injury or mortality due to predation or recreational activities.

Exotic predators such as African clawed frogs, bullfrogs, mosquitofish (*Gambusia affinis*), red swamp crayfish, and green sunfish (*Lepomis cyanellus*), prey on or compete for resources with unarmored threespine sticklebacks. In addition, certain non-native species may serve as vectors for the Ich parasite (*Ichthyopthirius multifilis*) that could infect populations of unarmored threespine stickleback. Populations of unarmored threespine stickleback in the Angeles National Forest were severely affected by the introduction of Ich in 1995 (U.S. Forest Service 2000). Introduced goldfish (*Carasius auratus*) were suspected to be the source of the Ich infestation.

ENVIRONMENTAL BASELINE

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations (CFR) 402.02). For the purposes of this biological opinion and based on information provided by the Air Force, we consider the action area to measure 149 acres, including the 0.875 mile of San Antonio Creek and adjacent non-native grassland and agricultural areas (119 acres) and the nearby willow collection area (30 acres).

Ten distinct vegetation types were identified within the project area, and with the exception of the agricultural fields, the vegetation occurs as a mosaic of small patches or narrow bands. The vegetation types within the action area and their approximate acreages include: non-native

grassland (38.7 acres), central coast scrub (12.1 acres), mixed central coast scrub/non-native grassland (2.8 acres), native grassland (0.2 acre), willow riparian (30.7 acres), mixed willow riparian/central coast scrub (0.9 acre), agricultural (52.9 acres) wetland (4.5 acres), non-native woodland (2.3 acres), and ruderal (3.3 acres).

San Antonio Creek is a relatively small coastal drainage with low gradient on VAFB. It is mostly surrounded by an expansive sandy to muddy floodplain well known for its extensive willow forests and abundance of wildlife. The vast majority of the creek is slow moving with a sandy or muddy bottom. The soft sediments hold abundant groundwater that is pushed to the surface near the inland boundary of VAFB and in other areas of outcropping hard substrate. The sandy to muddy sediments also provide the substrate for the vast willow forest cover. The shade of the forest, groundwater upwelling, and cool climate keep water temperatures cool and provide some woody debris that provides valuable cover for fishes. The willow cover is so prevalent over much of the stream that aquatic and emergent vegetation is often absent or minimal. Occasional open areas allow more sun to reach the stream and its banks, and in these areas vegetation is better developed, sometimes clogging or choking the entire stream.

California Red-legged Frog

Protocol-level surveys were not conducted for the California red-legged frog within the project areas; however, California red-legged frogs have been documented in nearly all permanent streams and ponds on VAFB, including San Antonio Creek. Surveys conducted by Dr. Susan Christopher from 1995 to 2002 documented the presence of California red-legged frogs in various life stages in 98 out of 109 ephemeral, wetland, and riparian sites surveyed on VAFB. The highest concentrations of California red-legged frogs are in San Antonio Creek and the permanent ponds (J. Uyehara, VAFB biologist, pers. comm. 2008).

El Segundo Blue Butterfly

Dr. Pratt and Dr. Arnold led a survey effort on VAFB during the summer of 2007, with assistance from VAFB staff and Mantech SRS Technologies, to document where the El Segundo blue butterfly occurs on VAFB. The survey methodology included selecting sites at approximate 1-mile intervals in large contiguous stretches of potentially suitable habitat within the extensive coastal sand dune habitat on north VAFB; visiting locations known to be occupied by the El Segundo blue butterfly and expanding the survey to a wider perimeter until no additional butterflies were observed or potential habitat ceased; and surveying suitable habitat locations not previously known to support the El Segundo blue butterfly (Mantech SRS Technologies 2008).

The action area is approximately 5.4 miles away from the nearest documented occurrence of the El Segundo blue butterfly on VAFB. The Air Force conducted surveys for the El Segundo blue butterfly in the action area in February 2008, outside of the period when El Segundo blue butterflies are generally active and observable. Approximately 150 coast buckwheat plants occur adjacent to a previously disturbed staging area and the presence of coast buckwheat plants represents potential habitat for the El Segundo blue butterfly on VAFB. Because the surveys

were conducted at a time when this butterfly would not be observable, we are uncertain whether they occupy the coast buckwheat plants within the action area.

Unarmored Threespine Stickleback

Surveys for the unarmored threespine stickleback were not conducted for this project; however, San Antonio Creek has been surveyed numerous times in previous years for the presence of unarmored threespine sticklebacks and other special-status fishes. The following information was obtained from the Special-Status Fish Species Survey Report for San Antonio Creek (Tetra Tech 1999).

Dr. Camm Swift conducted surveys for special-status fish in San Antonio Creek from near the Lompoc-Casmalia Road crossing downstream to the lagoon (Tetra Tech 1999). Dr. Swift surveyed San Antonio Creek by visual surveys confirmed by occasional seine hauls; careful seining, removal, counting, measuring, and returning of all fishes in 100-meter (269-square-foot) sections in the creek; setting and monitoring a downstream trap for seaward migrating steelhead (*Oncorhynchus mykiss*) just above Lompoc-Casmalia Road; and careful seining of multiple, 25-square-meter quadrats in the lagoon, primarily to get quantitative estimates of the federally endangered tidewater goby (*Eucyclogobius newberryi*) population in the lagoon (Tetra Tech 1999).

The unarmored threespine stickleback was the most common fish observed in the creek above the lagoon and is much more abundant in the upper half of the creek area that was surveyed due to the lower stream gradient, slower water velocity, broader channel, and lack of native or invasive aquatic predators. The unarmored threespine stickleback comprised approximately 70 percent of the number of fish observed (excluding the survey transects and lagoon surveys) and comprised 99 percent of fish observed in the transects along with small numbers of arroyo chub (*Gila orcutti*), prickly sculpin (*Cottus asper*), mosquitofish, and tidewater goby (Tetra Tech 1999).

Approximately 48,000 unarmored threespine sticklebacks were estimated to inhabit the lower 8 kilometers (4.97 miles) of the creek above the lagoon with an average of 1.94 sticklebacks per meter (1 stickleback per 1.67 feet), assuming that the deeper ponded areas not represented in the survey transects had about the same number of sticklebacks as the areas surveyed. The unarmored threespine stickleback occurs upstream of VAFB in San Antonio Creek at least as far as Barka Slough (Tetra Tech 1999). The density of stickleback was the highest in the 2 kilometers (1.24 miles) above and below the El Rancho Road crossing, which is approximately 3 miles downstream of the project site.

EFFECTS OF THE ACTION

The restoration project would occur within 0.875 mile of San Antonio Creek and is designed to protect the creek banks from erosion, promote channel stability, and restore the ecological function of the creek. The project would result in temporary impacts to approximately 149 acres,

including wetland and riparian habitats of San Antonio Creek and neighboring agricultural fields and areas comprised of non-native grassland. The project would adversely affect habitat of the California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly and could also result in adverse effects to individuals of these species. However, the project would have eventual beneficial effects by improving the function of unarmored threespine stickleback and California red-legged frog habitat within this section of the creek.

The El Segundo blue butterfly could be adversely affected by the project because ground-disturbing activities have the potential to remove or damage a patch of coast buckwheat plants that occurs within the action area. The El Segundo blue butterfly spends its entire life cycle in close association with coast buckwheat plants; therefore, if the plants are removed or damaged it could result in injury or mortality to all El Segundo blue butterflies associated with these plants.

Direct impacts to California red-legged frog adults, subadults, and tadpoles and unarmored threespine stickleback adults, fry, and eggs within the footprint of the project include injury or mortality from being crushed, cut, or dismembered by project vehicles and equipment; smothered by increased sedimentation; and crushed by worker foot traffic. Workers may intentionally disturb, injure, or kill California red-legged frogs and unarmored threespine sticklebacks; however, these effects would be substantially reduced because the Air Force scheduled the project to occur outside of the California red-legged frog breeding season and Service-approved biologists will conduct surveys to capture and relocate all California red-legged frogs and unarmored threespine sticklebacks within work areas prior to the onset of construction activities.

The capture and handling of California red-legged frogs and unarmored threespine sticklebacks to move them from a work area may result in injury or mortality. Mortality may occur as a result of improper handling, containment, transport of individuals, or from releasing them into unsuitable habitat. The Air Force will employ Service-approved biologists to minimize this risk.

California red-legged frogs and unarmored threespine sticklebacks could be adversely affected as a result of suspended sediments being released into the creek during construction activities. Excavation associated with the removal of vegetation, sediment, or channel shaping may cause erosion. This may smother California red-legged frogs and nests of unarmored threespine sticklebacks or reduce the availability of plants and insects that serve as their habitat and food sources. Installing silt fencing, implementing best management practices, and diverting the active creek channel around the work areas to ensure unimpeded flow would minimize this effect.

Noise and vibration may cause California red-legged frogs to temporarily abandon habitat adjacent to work areas. This disturbance may increase the potential for predation and desiccation when California red-legged frogs leave shelter sites. Using a Service-approved biologist to conduct daily systematic searches of the work areas for California red-legged frogs prior to and during construction activities would minimize this effect.

Trash left during or after construction activities may result in an increased number of predators, such as raccoons or opossums (*Didelphis virginiana*), that may injure or kill California red-legged frogs. Removing trash from the project site on a daily basis would reduce this effect.

Chytrid fungus could be spread if infected California red-legged frogs are relocated to areas with uninfected California red-legged frogs. Chytrid fungus is a water-borne fungus that can be spread through direct contact between aquatic animals and by a spore that can move short distances through the water. The fungus only attacks the parts of an amphibian's skin that have keratin (thickened skin), such as the mouthparts of tadpoles and the tougher parts of adults' skin, such as the toes. The fungus can decimate amphibian populations, causing fungal dermatitis which usually results in death in 1 to 2 weeks, but not before infected animals may have spread the fungal spores to other ponds and streams. Once a pond has become infected with Chytrid fungus, the fungus stays in the water for an undetermined amount of time. The Air Force would reduce the risk of spreading Chytrid fungus by using Service-approved biologists.

Accidental spills of hazardous materials or careless fueling or oiling of vehicles or equipment could degrade aquatic habitat or dispersal habitat to a degree where California red-legged frogs and unarmored threespine sticklebacks are adversely affected or killed. This effect would be greatly reduced because the Air Force will implement a spill prevention plan; store hazardous materials and stage, repair, and maintain project equipment outside of the riparian corridor in designated areas; and use catch pans or protective mats to prevent the contamination of the creek bed.

The project would benefit the California red-legged frog and unarmored threespine stickleback because it would improve riparian habitat within the action area by: installing grade-control structures that would establish pool habitat and low-flow fish passages, excavating the north creek bank to create floodplain terraces, installing biotechnical plantings that would provide geotechnical strength, reduce erosion susceptibility, and enhance riparian habitat; and by restoring all areas disturbed by the project to an ecologically functional state using local, native plant species. Additionally, the Air Force would monitor and eradicate non-native invasive plant species in the action area for 5 years following the completion of the project.

In summary, the restoration project would result in temporary impacts to El Segundo blue butterfly habitat and could result in individual butterflies being injured or killed. The project would also result in substantial temporary adverse impacts to California red-legged frog and unarmored threespine stickleback habitat within the action area; however, individuals of the California red-legged frog and unarmored threespine stickleback have a small potential to be injured or killed because the Air Force will implement a suite of avoidance and minimization measures as part of the project, including capturing and relocating all California red-legged frog and unarmored threespine stickleback individuals from the project area prior to the onset of the construction activities. The project would provide a long-term benefit to California red-legged frogs and unarmored threespine sticklebacks by reducing erosion and downstream sediment, creating low-flow fish passages and pool habitat, restoring native vegetation, and improving the overall function and value of their respective habitats in San Antonio Creek.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. We are not aware of any non-Federal actions that are reasonably certain to occur in the action area.

CONCLUSION

After reviewing the current status of the California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly, the environmental baseline, the effects of the action, and the cumulative effects, it is the Service's biological opinion that the San Antonio Creek restoration project will not jeopardize the continued existence of the California red-legged frog, unarmored threespine stickleback, or El Segundo blue butterfly. We reached this conclusion because:

1. In comparison to the amount of habitat available to the California red-legged frog and El Segundo blue butterfly throughout their respective ranges, only a very small amount of habitat would be adversely affected by the construction activities, and the majority of these effects would be temporary;

2. Few, if any, California red-legged frogs, unarmored threespine sticklebacks, or El Segundo blue butterflies are likely to be killed or injured;

3. Opportunities for the California red-legged frog and unarmored threespine stickleback to feed, breed, and shelter would remain and most likely improve after the construction activities are complete;

4. The Air Force will implement protection measures as part of the project description to avoid and minimize the adverse effects on the California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly; and

5. The project would provide an overall benefit to California red-legged frogs and unarmored threespine stickleback within San Antonio Creek.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is

defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the Air Force for the exemption in section 7(o)(2) to apply. The Air Force has a continuing duty to regulate the activity covered by this incidental take statement. If the Air Force fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Air Force must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

We anticipate the following incidental take may result from the proposed San Antonio Creek restoration project. All California red-legged frogs and unarmored threespine sticklebacks found within the action area would be subject to take because the Air Force will attempt to capture and relocate all individual frogs and sticklebacks out of work areas prior to the onset of construction activities. A subset of the captured California red-legged frogs and unarmored threespine sticklebacks may experience a disruption of normal behavioral patterns to the point that reaches the level of harassment. However, capture and relocation is intended to reduce the potential for mortality or injury that could result from implementing the project. Individuals not detected by the pre-construction surveys may be killed or injured anywhere within the action area. Therefore, based on the number of California red-legged frogs and unarmored threespine sticklebacks previously observed in San Antonio Creek and the measures that the Air Force will implement, we anticipate that no more than 2 adults, subadults, or tadpoles of the California red-legged frog, and no more than 2 unarmored threespine stickleback adult or fry would be killed or injured as a result of the proposed action.

In addition, all El Segundo blue butterflies found within the action area would be subject to take because the construction activities may damage or destroy the patch of coast buckwheat plants that occurs in the action area and this butterfly spends its entire life cycle in close association with coast buckwheat plants. Generally, El Segundo blue butterflies are not common anywhere they are observed and the population at VAFB occurs in much lower densities than other known populations (Pratt, pers. comm. 2007). Therefore, we anticipate that a very small number of butterflies have the potential to be injured or killed within the action area.

Incidental take of California red-legged frogs and unarmored threespine sticklebacks may be difficult to determine because of their small body size, finding a dead or impaired specimen is unlikely, and fluctuations in their population from year to year may mask losses resulting from factors unrelated to the project. Detecting dead or injured El Segundo blue butterflies would be

very difficult because of their cryptic nature, fluctuations in abundance from one generation to the next and from one flower head to another, and potentially high parasitism and natural mortality rates (R. Arnold, Entomological Consulting Services, pers. comm. 2007). We do not expect that the loss of the anticipated numbers of California red-legged frogs, unarmored threespine sticklebacks, or El Segundo blue butterflies would compromise the ability of these species to survive and recover.

This incidental take statement does not exempt any activity from the prohibitions against take contained in section 9 of the Act that is not incidental to the action as described in this biological opinion. The California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly may be taken only within the boundaries of the action area.

REASONABLE AND PRUDENT MEASURES

We believe the following reasonable and prudent measures are necessary and appropriate to minimize take of the California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly during the San Antonio Creek restoration project:

1. The Air Force must ensure that the level of incidental take that occurs during project implementation is commensurate with the analysis contained herein.

2. The Air Force must use well-defined operational procedures and qualified personnel to minimize incidental take of the California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly during project implementation.

3. The Air Force must ensure plans relating to the inadvertent release of hazardous materials are in place prior to the onset of ground-disturbing activities.

TERMS AND CONDITIONS

To be exempt from the prohibitions in section 9 of the Act, the Air Force must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The following terms and conditions implement reasonable and prudent measure 1:

    a. If more than two (2) adults, subadults, or tadpoles of the California red-legged frog are found dead or injured, the Air Force must contact the Ventura Fish and Wildlife Office immediately. We will then review the project's actions to determine if additional protective measures are needed. The cause of death or injury must be determined by a Service-approved biologist. Construction activities may continue during this review period, provided that all protective measures proposed by the Air Force and the terms and conditions of this biological opinion have been and continue to be implemented.

b. If more than two (2) adults or fry of the unarmored threespine stickleback are found dead or injured, the Air Force must contact the Ventura Fish and Wildlife Office immediately. We will then review the project's actions to determine if additional protective measures are needed. The cause of death or injury must be determined by a Service-approved biologist. Construction activities may continue during this review period, provided that all protective measures proposed by the Air Force and the terms and conditions of this biological opinion have been and continue to be implemented.

c. We assume that the average coast buckwheat plant contains about 300 flower heads and may produce 30 El Segundo blue butterfly adults. However, the population at VAFB occurs in much less dense numbers than other known populations (Pratt, pers. comm. 2007). Generally, El Segundo blue butterflies are not common anywhere they are observed. If more than three (3) El Segundo blue butterflies are found dead or injured, the Air Force must notify the Ventura Fish and Wildlife Office immediately. We will then review the project's actions to determine if additional protective measures are needed. The cause of death or injury must be determined by a Service-approved biologist. Construction activities may continue during this review period, provided that all protective measures proposed by the Air Force and the terms and conditions of this biological opinion have been and continue to be implemented.

2. The following terms and conditions implement reasonable and prudent measure 2:

a. Jamie Uyehara, Tom Murphey, Valerie Hubbart, Morgan Ball, Alice Abela, John LaBonte, and Carl Page are hereby authorized to independently survey for, monitor, capture, and relocate California red-legged frogs for the purposes of this biological opinion. Carl Page, Jamie Uyehara, and James "Tim" Belton are hereby authorized to independently to survey for, monitor, capture, and relocate unarmored threespine sticklebacks for the purposes of this biological opinion. The Air Force must request our approval of any other biologist it wishes to employ to capture and relocate California red-legged frogs and unarmored threespine sticklebacks from the project area at least 15 days prior to any such activities being conducted.

Please be advised that possession of a 10(a)(1)(A) permit for the covered species does not substitute for the implementation of this measure. Authorization of Service-approved biologists is valid for this project only.

b. California red-legged frogs and unarmored threespine sticklebacks must be relocated from the project site and from all areas where construction activities could result in mortality or injury to the species.

c. When capturing and removing California red-legged frogs and unarmored threespine sticklebacks from the project area, the Service-approved biologist(s) must minimize the amount of time that animals are held in captivity. During this time, California red-legged frogs and unarmored threespine sticklebacks must be maintained in a manner that does not expose them to temperatures or any other environmental conditions that could cause injury or undue stress. California red-legged frogs must be captured only by hand or dip net and transported in buckets separate from other species.

d. To avoid transferring disease or pathogens between aquatic habitats during the course of surveys and handling of California red-legged frogs, the Service-approved biologist(s) must follow the Declining Amphibian Population Task Force's Code of Practice. A copy of this Code of Practice is enclosed. You may substitute a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water) for the ethanol solution. Care must be taken so that all traces of the disinfectant are removed before entering the next aquatic habitat.

e. The Service-approved biologist(s) must have the authority to stop specific work activities until appropriate corrective measures are taken when unintended effects to California red-legged frogs or unarmored threespine sticklebacks occur. If a California red-legged frog or unarmored threespine stickleback is observed within a designated work area and cannot be avoided, all work must stop until the animal is relocated by a Service-approved biologist to outside of the work area or until it leaves the work area on its own accord.

3. The following term and condition implements reasonable and prudent measure 3:

Prior to the onset of any ground-disturbing activities within or adjacent to California red-legged frog or unarmored threespine stickleback habitat, a plan to prevent inadvertent spills of hazardous materials and to remediate any such spill that may occur must be submitted to, and approved by, the Air Force (30 CES/CEV). These plans must specifically discuss the implications of spills in habitat of the California red-legged frog or unarmored threespine stickleback and include methods to remediate these spills in a manner that is least damaging to habitat for special-status species.

REPORTING REQUIREMENT

The Air Force must provide a report to the Service within 90 days following the completion of the activities covered by this biological opinion. The report must document the number of California red-legged frogs, unarmored threespine sticklebacks, and El Segundo blue butterflies killed or injured during the course of the project; a summary of how the terms and conditions worked; and any suggestions of how these measures could be changed to improve conservation of these species while facilitating compliance with the Act. This document will assist the

Service in evaluating appropriate measures for conservation of the California red-legged frog, unarmored threespine stickleback, and El Segundo blue butterfly during future projects.

DISPOSITION OF DEAD OR INJURED SPECIMENS

Upon locating a dead or injured California red-legged frog, unarmored threespine stickleback, or El Segundo blue butterfly, initial notification must be made to the Service's Division of Law Enforcement by facsimile at (310) 328-6399, and the Ventura Fish and Wildlife Office at (805) 644-3958 immediately and in writing at the letterhead address within 3 working days. Notification must include the date, time, and location of the carcass; cause of death, if known; and any other pertinent information.

Care must be taken in handling injured specimens to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible state for later analysis. The finder of injured specimens has the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed, unless to remove it from the path of further harm or destruction. Should any listed species survive injury, the Service must be contacted regarding their final disposition.

The remains must be placed with educational or research institutions holding the appropriate State and Federal permits, such as the Santa Barbara Natural History Museum (Contact: Paul Collins, Santa Barbara Natural History Museum, Vertebrate Zoology Department, 2559 Puesta Del Sol, Santa Barbara, California 93460, (805) 682-4711, extension 321).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse affects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

> The Air Force should continue conducting El Segundo blue butterfly surveys of any areas at VAFB that contain coast buckwheat to refine our knowledge of the subspecies' distribution.

We request notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species.

REINITIATION NOTICE

This concludes formal consultation on the effects of the San Antonio Creek restoration project at VAFB. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may adversely

affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this biological opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16).

If you have any questions regarding this biological opinion, please contact Nic Huber of my staff at (805) 644-1766, extension 249.

Sincerely,

Roger P. Root

Roger P. Root
Assistant Field Supervisor

Enclosure

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The Declining Amphibian Populations Task Force Fieldwork Code of Practice

A. Remove mud, snails, algae, and other debris from nets, traps, boots, vehicle tires, and all other surfaces. Rinse cleaned items with sterilized (e.g., boiled or treated) water before leaving each work site.

B. Boots, nets, traps, and other types of equipment used in the aquatic environment should then be scrubbed with 70 percent ethanol solution and rinsed clean with sterilized water between study sites. Avoid cleaning equipment in the immediate vicinity of a pond. wetland, or riparian area.

C. In remote locations, clean all equipment with 70 percent ethanol or a bleach solution, and rinse with sterile water upon return to the lab or "base camp" Elsewhere, when washing-machine facilities are available, remove nets from poles and wash in a protective mesh laundry bag with bleach on the "delicates" cycle.

D. When working at sites with known or suspected disease problems, or when sampling populations of rare or isolated species, wear disposable gloves[2] and change them between handling each animal. Dedicate sets of nets, boots, traps, and other equipment to each site being visited. Clean them as directed above and store separately at the end of each field day.

E. When amphibians are collected, ensure that animals from different sites are kept separately and take great care to avoid indirect contact (e.g., via handling, reuse of containers) between them or with other captive animals. Isolation from unsterilized plants or soils which have been taken from other sites is also essential. Always use disinfected and disposable husbandry equipment.

F. Examine collected amphibians for the presence of diseases and parasites soon after capture. Prior to their release or the release of any progeny, amphibians should be quarantined for a period and thoroughly screened for the presence of any potential disease agents.

G. Used cleaning materials and fluids should be disposed of safely and, if necessary, taken back to the lab for proper disposal. Used disposable gloves should be retained for safe disposal in sealed bags.

The Fieldwork Code of Practice has been produced by the Declining Amphibian Populations Task Force with valuable assistance from Begona Arano, Andrew Cunningham, Tom Langton, Jamie Reaser, and Stan Sessions.

For further information on this Code, or on the Declining Amphibian Populations Task Force, contact John Wilkinson, Biology Department, The Open University, Walton Hall, Milton Keynes, MK7 6AA, UK. E-mail: DAPTF@open.ac.uk Fax: +44 (0) 1908-654167

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[2] Latex gloves should not be used. They are toxic to amphibians. Use vinyl or nitrile disposable gloves instead.

APPENDIX D

Wetland Delineation

Assessment of Wetland Habitats at the San Antonio Creek Restoration Site

Vandenberg Air Force Base, California

April 2008

Prepared for

30th Space Wing Environmental Flight
30 CEV/CEV
1028 Iceland Ave.
Vandenberg AFB, CA 93437-6010

Prepared by

ManTech SRS Technologies, Inc.
Mission Services Division
102 East Ocean Avenue
Lompoc, CA 93436

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Acronyms and Abbreviations

AFB	Air Force Base
H	Herb stratum
FAC	Facultative Plant
FACU	Facultative Upland Plant
FACW	Facultative Wetland Plant
MSRS	ManTech SRS Technologies
OBL	Obligate Wetland Plant
OHWM	Ordinary High Watermark
S	Sapling/Shrub stratum
T	Tree stratum
UPL	Obligate Upland Plant
USACE	United States Army Corps of Engineers
V	Woody vine stratum
VAFB	Vandenberg Air Force Base
WIS	Wetland Indicator Status

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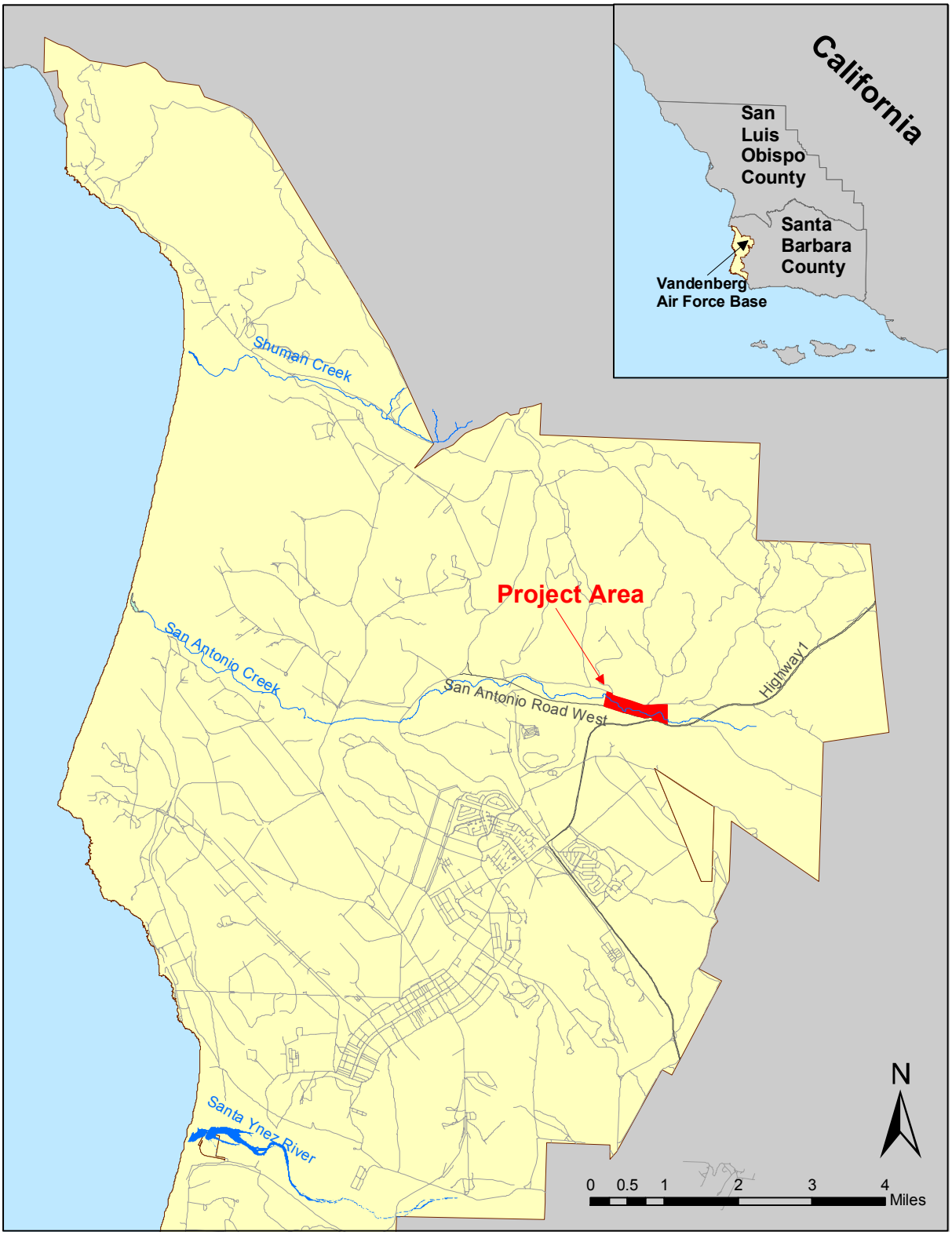
1.0 Introduction

San Antonio Creek flows through the northern portion of Vandenberg Air Force Base (VAFB). North of San Antonio Road West, the creek has experienced down cutting and scour that threaten the integrity of San Antonio Road West and the Lee Road Utility Bridge. This erosion necessitated an emergency repair in 1998 which involved the installation of extensive rip-rap embankments at the Lee Road Utility Bridge crossing and at the San Antonio Road West Creek Bend. A complete description of emergency repairs undertaken in 1998 is included in the Environmental Assessment for the San Antonio Creek Restoration Project (VAFB *In Progress*).

Figure 1. Rip-rap installed at the San Antonio Road West creek bend during the 1998 emergency action.

The 1998 emergency repair does not constitute a permanent fix to erosion issues threatening San Antonio Road West and the Lee Road Utility Bridge. Therefore, VAFB proposes to remediate the extensive damage to the banks and stream channel in the area between Barka Slough and the downstream crossing of San Antonio Road West by implementing restoration actions in San Antonio Creek. The goals of the proposed project are to restore hydrologic function, enhance stream stability, minimize the potential for further erosion, protect several creek embankments, and promote the return of proper channel function. A complete description of proposed restoration activities is included in the Environmental Assessment for the San Antonio Creek Restoration Project (VAFB *In Progress*). Map 1 illustrates the location of the proposed project area.

To quantify wetland habitat likely to be impacted by the proposed restoration, a wetland delineation was conducted within the 105 acre proposed project area in February through April 2008. ManTech SRS Technologies, Inc. (MSRS) biologists experienced with federal wetland delineation methodology performed the wetland delineation.



Map 1. Location of proposed San Antonio Creek restoration project area.

2.0 Methods

Wetland surveys were conducted within the project area for the proposed San Antonio Creek restoration from February through April 2008. In addition to field surveys, 2004 and 2005 aerial imagery of the project area, and the Soil Survey of Northern Santa Barbara Area, California (United States Department of Agriculture [USDA] 1972) were consulted. Wetlands were delineated in accordance with United States Army Corps of Engineers (USACE) Wetland Delineation Manual (USACE 1987, 2006). Potential wetlands were evaluated for the presence of hydric vegetation, wetland hydrology and hydric soils.

2.1 Vegetation

Hydric vegetation is defined as having more than fifty percent of the dominant species able to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions. When classifying vegetation, plants are grouped into four strata depending on height, growth habit and morphology (Table 1; Wetland Training Institute, Inc. [WTI] 1995).

Table 1: Vegetation Strata.

Code	Stratum	Description
H	Herb	All non-woody plants, and woody plants less than 3.2 feet in height
S	Sapling/Shrub	Woody plants greater than or equal to 3.2 feet in height, but less than 3.0 inch diameter at breast height
T	Tree	Woody plants greater than or equal to 3 inches at breast height, regardless of height
V	Woody vine	Woody climbing plants greater than or equal to 3.2 feet in height

Dominant species were determined for each strata using the 50/20 rule. Plants were evaluated in order of descending abundance until species comprising at least fifty percent of the vegetation in a particular stratum, as determined by relative cover, had been accounted for. Any additional species occupying at least twenty percent of the stratum were also listed as dominants. Relative cover was determined by visual estimation.

To determine if vegetation present was hydric, the wetland indicator status (WIS) for dominant species was defined based on assignments from the National List of Vascular Plant Species that Occur in Wetlands (United States Fish and Wildlife Service [USFWS] 1997), which places plants in one of five categories (Table 2).

The threshold for hydrophytic vegetation is met when fifty percent or more of the dominant species are rated facultative plants (FAC) or wetter. In border line cases, such as those where all of the dominants were rated FAC or drier, FAC-Neutral Test results were used to clarify status of the vegetation. For a FAC-Neutral test the ratio of dominants rated FACW- or wetter and dominants rated FACU+ or drier is calculated. Ratios equaling one or greater constitute positive results and support the designation of vegetation as hydric.

Table 2: Wetland Indicator Status

Code	WIS	Description
OBL	Obligate Wetland	Plants that almost always occur (estimated probability 99%) in wetlands under natural conditions, but may also occur rarely (estimate probability 1%) in non-wetlands
FACW	Facultative Wetland	Plants that usually occur (estimated probability 67% to 99%) in wetlands, but also occur (estimated probability 1% to 33%) in non-wetlands.
FAC	Facultative	Plants with a similar likelihood (estimated probability 33% to 67%) of occurring in both wetlands and non-wetlands.
FACU	Facultative Upland	Plants that sometimes occur (estimated probability 1% to 33%) in wetlands, but occur more often (estimated probability 67% to 99%) in non-wetlands.
UPL	Obligate Upland	Those plants that rarely (estimated probability 1%) occur in wetlands, but occur almost always (estimated probability 99%) in non-wetlands under natural conditions.

*Modifiers, + or – , further characterize WIS ranks with + plants favoring the wetter end of the spectrum and – favoring the drier end of each ranking category. Plants not assigned a WIS are assumed UPL unless there is supporting documentation available to the contrary.

2.2 Hydrology

Areas with wetland hydrology are inundated either permanently or periodically at mean water depths less than or equal to 6.6 feet, or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation. Positive findings for wetland hydrology require the finding of at least one primary indicator or two secondary indicators (WTI 1995).

Plots were subject to visual inspection for indicators of hydrology such as inundation, water marks, drift lines, sediment deposits, drainage patterns in wetlands, and water stained leaves. Pits were excavated with a 16 inch bladed drain spade to a depth of at least 12 inches to characterize depth of free water, depth of saturated soil, and determine the presence of oxidized rhizosheres surrounding live roots. FAC-Neutral test results were also considered when making a determination of wetland hydrology.

2.3 Soils

Hydric soils possess characteristics that are associated with reducing soil conditions indicative of saturation, flooding, or ponding, for sufficient duration during the growing season to develop anaerobic conditions in the upper part (WTI 1995). To determine if reducing conditions were present, soil profiles were examined.

Test pits were excavated and an intact soil core section, at least 10 inches in height spanning the vertical range of the pit, was removed from each hole. Soil color and texture were characterized from this sample. Soil color was determined by the comparison of moist samples to the color plates in the Munsell Soil Color Charts (2000). Texture was evaluated by touch, following procedures adapted from Steve Thien (WTI 2003). In cases

where soil was too dry for color and textural evaluations, water was added. The vertical span and distribution of various soil layers, as determined by color and textural differences, was measured and noted.

2.4 Waters of the United States

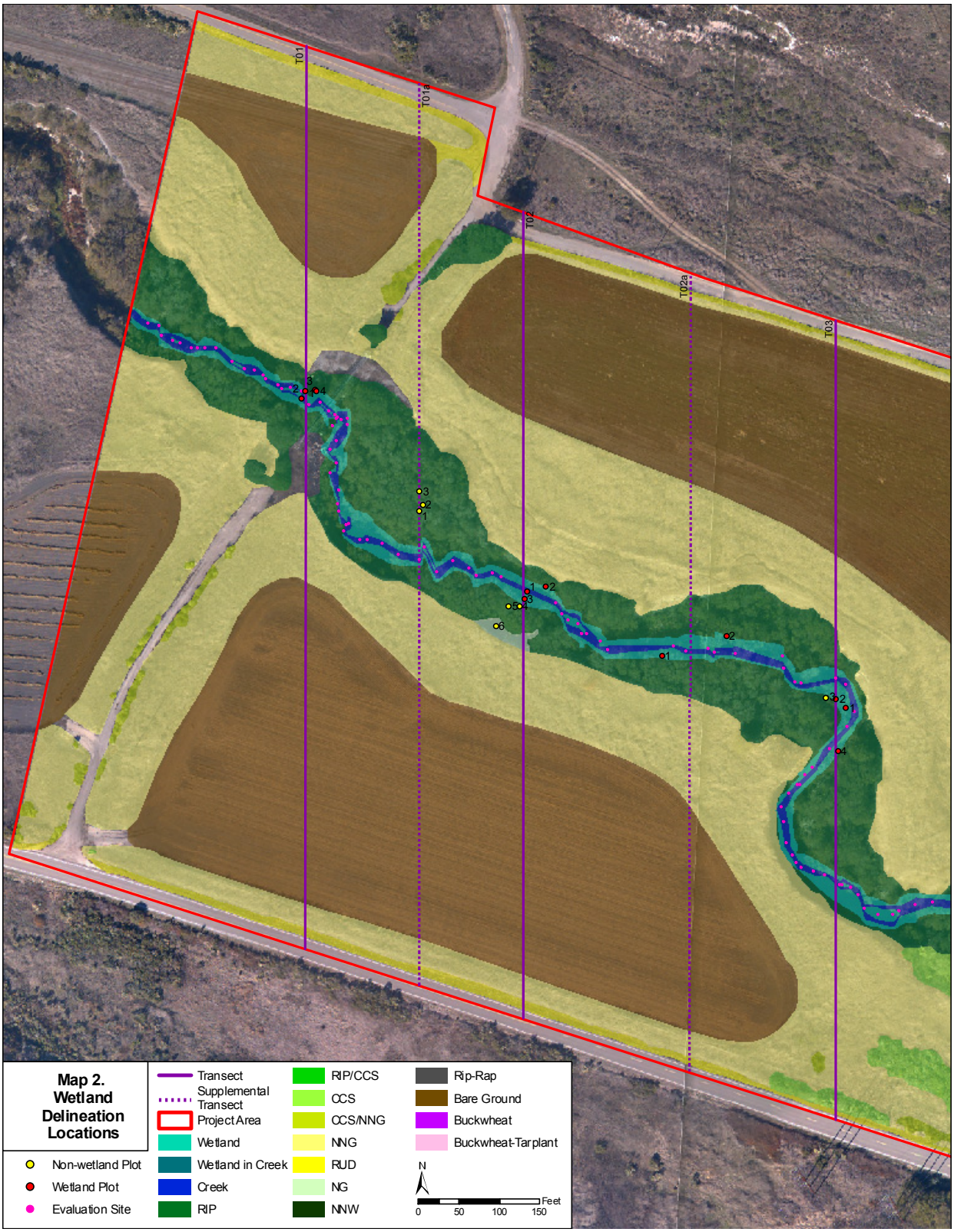
The limits of jurisdictional waters of the United States were determined using the Ordinary High Watermark (OHWM) as indicated by drift lines, waterstaining, and shelving present on the bank. Wetland extent adjacent to the creek, and areas encompassed by the creek were also measured.

2.5 Field Surveys and Mapping

Thirteen transects and four supplemental transects were established within the proposed project area. Transects were oriented in a north-south direction, perpendicular to the path of the creek, every 300 to 400 feet, with exact placement depending on site conditions. Supplemental transects were established in intervening areas where additional plots were needed to determine wetland boundaries.

Representative plots were chosen along each transect within different vegetation types, growing conditions and/or at wetland-upland interface areas. Plots had a 30-foot radius where conditions permitted. In cases where habitats and vegetation types were small or shaped irregularly, the plots were demarcated by boundaries of vegetation types. USACE wetland delineation forms characterizing vegetation, hydrology and soils were completed for each plot. The locations of soil test pits were marked with pin flags and mapped with Global Positioning System units (Trimble Geo XT, Trimble Geo XM, or Garmin IV).

Once indicators of wetland boundaries were determined, additional evaluation sites were established along the creek. At each evaluation site, creek width, wetland width, and the distance to the OHWM were estimated at a given heading (north, south, east, or west). Evaluation sites were established at changes in creek direction and width, wetland width, and OHWM distance. Site locations were mapped in the field with Trimble Geo XT. Estimated distances were plotted using ArcMap 9.2, and used to generate maps of wetlands, vegetation types, and the boundaries of Waters of the United States within the project area. Maps 2, 3, 4, and 5 illustrate the locations of transects, plots and evaluation sites.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T01a
T02
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T03
Map 2.
Wetland
Delineation
Locations
Non-wetland Plot
Wetland Plot
Evaluation Site
Transect
Supplemental Transect
Project Area
Wetland
Wetland in Creek
Creek
RIP
RIP/CCS
CCS
CCS/NNG
NNG
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NNW
Rip-Rap
Bare Ground
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Buckwheat-Tarplant
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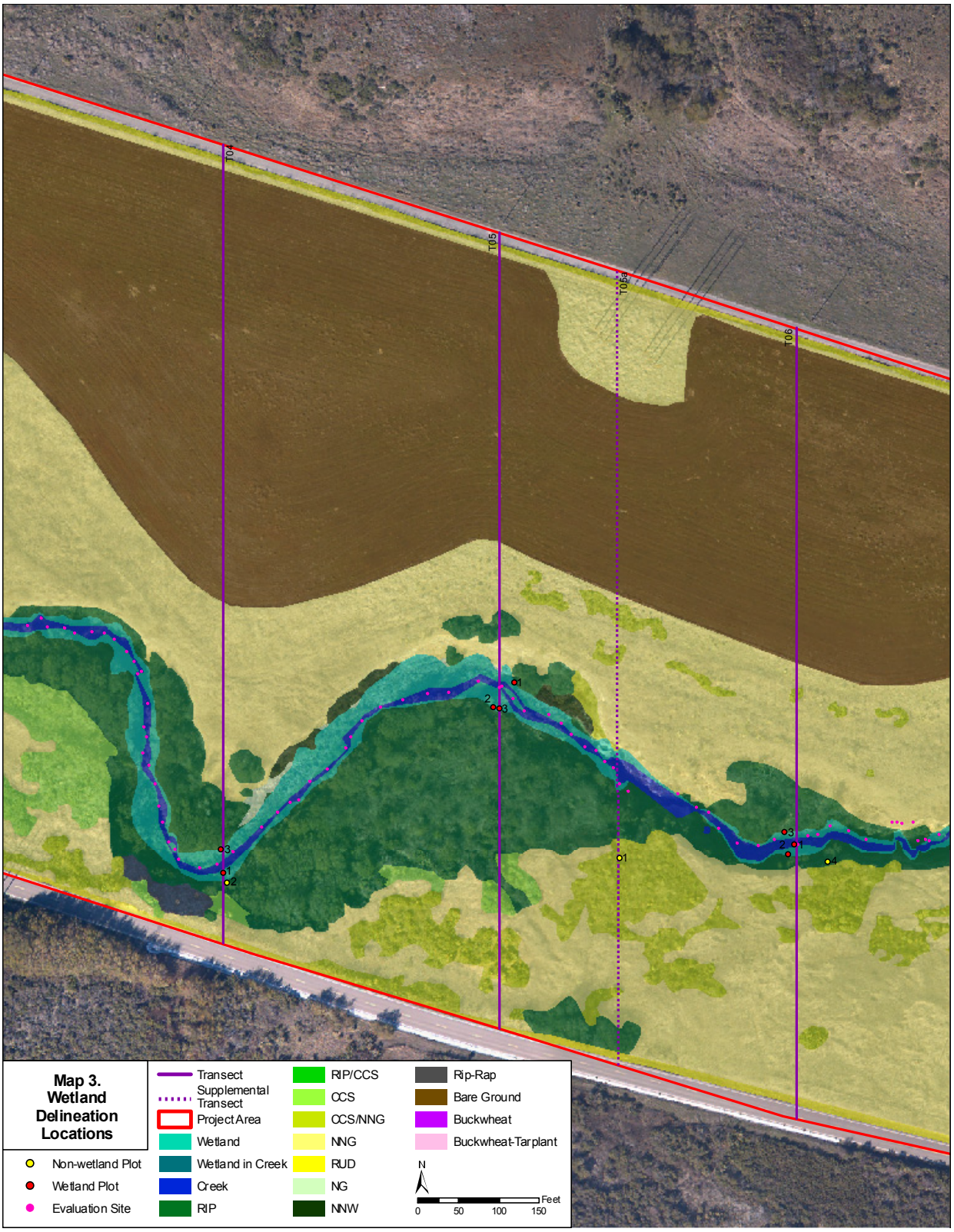
T04
T05
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T06
Map 3.
Wetland
Delineation
Locations
Transect
Supplemental Transect
Project Area
Wetland
Wetland in Creek
Creek
RIP
RIP/CCS
CCS
CCS/NNG
NNG
RUD
NG
NNW
Rip-Rap
Bare Ground
Buckwheat
Buckwheat-Tarplant
Non-wetland Plot
Wetland Plot
Evaluation Site
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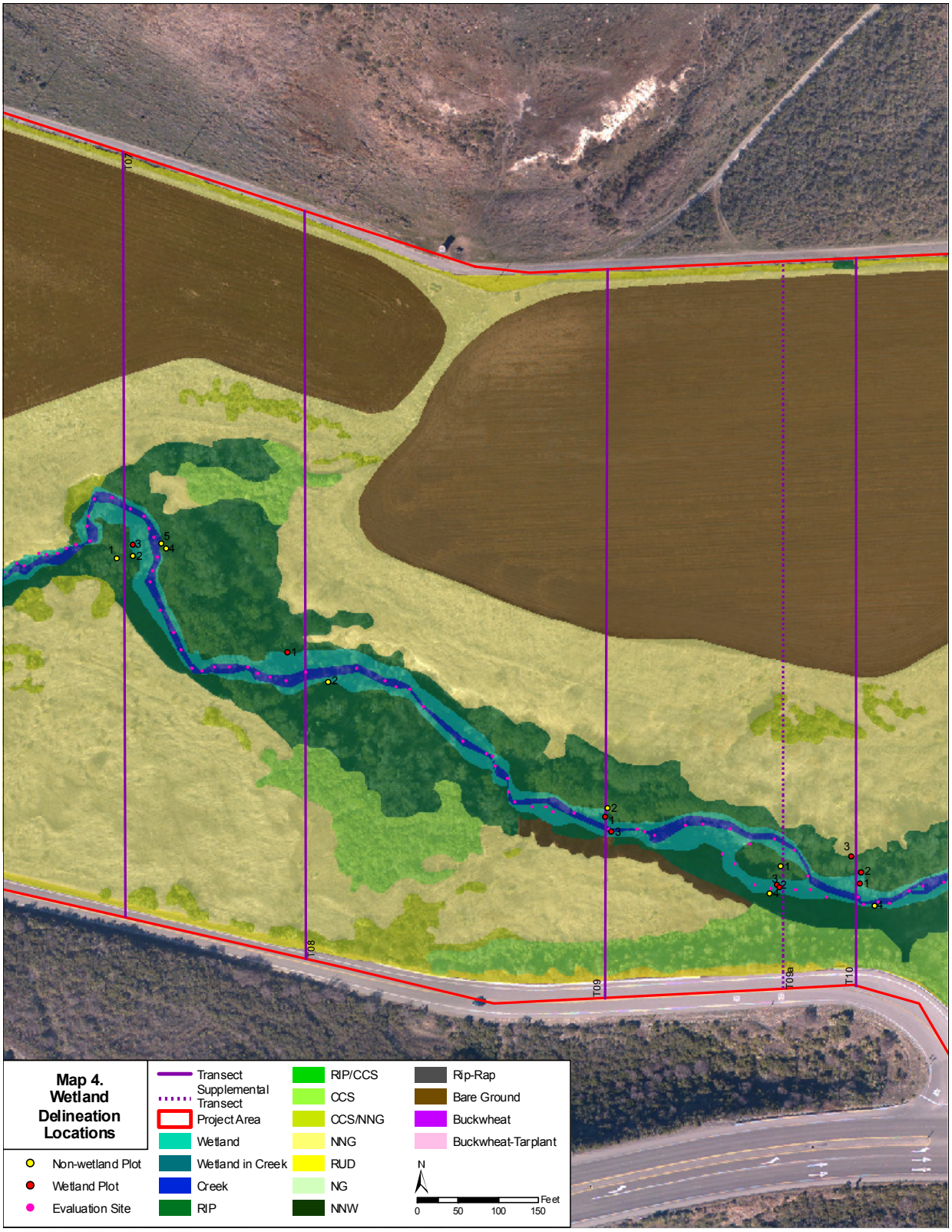
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Map 4.
Wetland
Delineation
Locations
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Evaluation Site
Transect
Supplemental Transect
Project Area
Wetland
Wetland in Creek
Creek
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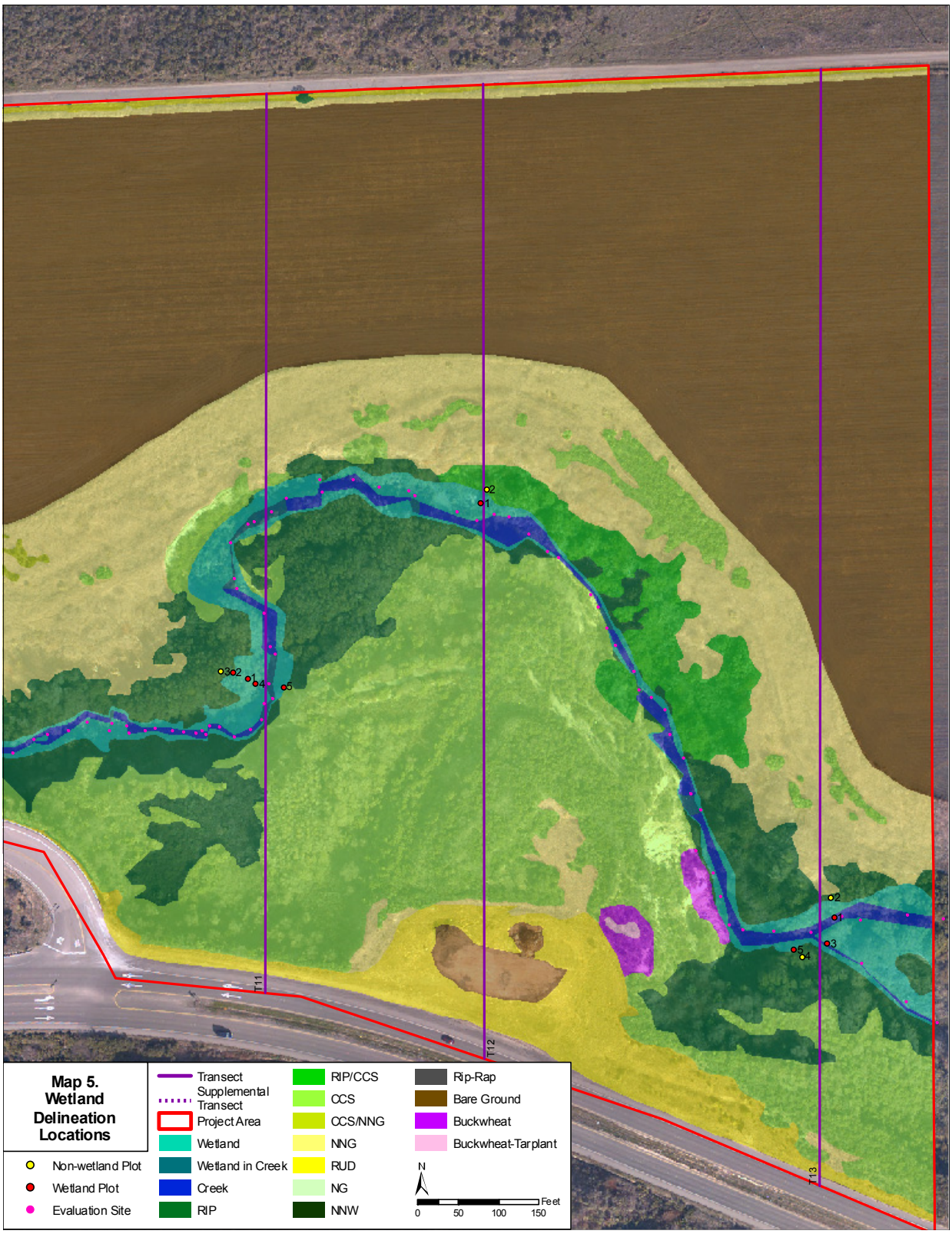
Map 5.
Wetland
Delineation
Locations
Non-wetland Plot
Wetland Plot
Evaluation Site
Transect
Supplemental Transect
Project Area
Wetland
Wetland in Creek
Creek
RIP
RIP/CCS
CCS
CCS/NNG
NNG
RUD
NG
NNW
Rip-Rap
Bare Ground
Buckwheat
Buckwheat-Tarplant
N
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Feet
T11
T12
T13

3.0 Results

3.1 Vegetation

Vegetation within the incised banks is composed primarily of hydric species and vegetation types (Table 3). Hydric vegetation types within the project area include willow riparian (RIP) and freshwater marsh (FWM). Willow riparian is the most extensive vegetation type within the incised creek channel. *Salix lasiolepis*, arroyo willow and *Salix laevigata*, red willow are the dominant tree species, with *Salix laevigata* predominating in low lying wetter areas. In areas with relatively open canopies understory vegetation is well developed and dominated by vining species such as *Rubus ursinus*, blackberry, and non-native herbaceous species such as *Lepidium draba*, hoary cress, and *Conium maculatum*, poison hemlock. In areas with dense canopy cover, little understory vegetation is present. Most willow riparian vegetation had no evidence of recent disturbance from water flow.

Table 3: Vegetation types within the project area

Code	Vegetation Type	Description	Acreage
BAR	Bare ground	Unvegetated slopes and disked agricultural fields	41.28
CCS	Central coast scrub	Shrub vegetation type dominated by *Baccharis pilularis* and *Artemisia californica*	9.08
CCS/NNG	Mixed central coast scrub non-native grassland	Mixed shrub and herbaceious vegetation dominated by *Baccharis pilularis*, *Brassica* spp. and *Conium maculatum*	2.28
NG	Native grassland	Herbaceous vegetation dominated by native grasses (*Leymus condensatus*) and herbs (*Urtica dioica*)	0.06
NNG	Non-native grassland	Non-native herbaceous vegetation dominated by *Brassica* spp., *Conium maculatum*, *Cardaria draba*, *Bromus* spp. or *Avena barbata*	29.51
NNW	Non-native woodland	Vegetation dominated by non-native trees, *Nicotiana glauca*	0.09
RIP	Willow riparian	Riparian vegetation dominated by *Salix lasiolepis* and *Salix laevigata*.	12.01
RIP/CCS	Mixed willow riparian central coast scrub	Mixed tree and shrub vegetation dominated by *Salix lasiolepis* and *Baccharis pilularis*	0.81
RIP-RAP	Rip-rap	Sparsely vegetated areas of mixed rocks, boulders and concrete installed for slope stabilization	0.21
RUD	Ruderal	Highly disturbed herbaceous vegetation, typically occurring on road shoulders or areas subjected to mowing	2.86
FWM	Fresh water marsh	Wetland vegetation dominated by *Typha* spp., *Scirpus* spp., or *Urtica dioica*. Riparian overstory may also be present.	3.18
Creek	Creek	Open water, may support fresh water marsh vegetations as season progresses	1.29

Figure 2. *Typha* sp. and *Rorippa nasturtium-aquaticum*, watercress, recolonizing creek bank. Inset: *Typha* sp. resprouting from exposed rhizome.

Fresh water marsh occurs primarily as an understory to the willow riparian in and along the creek, on low lying benches, and along ephemeral and secondary channels. Fresh water marsh grows in areas subject to scouring during winter high flows. *Typha* spp. (cattails), and *Scirpus* spp. (rushes) dominate in and along the creek, and ephemeral and secondary channels. Species such as *Urtica dioica* (stinging nettle) and *Baccharis douglasii* (marsh Baccharis) dominate on low lying benches. Much of this vegetation was washed away during the 2007-2008 winter rains. In the course of the present survey, it appeared in an early successional state, dominated by seedlings or resprouts from buried root material, with bare ground predominating. Due to the early successional state of this vegetation type, it is likely to become more extensively distributed than mapped during the field surveys, especially within and adjacent to the creek itself.

Upland vegetation types such as central coast scrub (CCS) dominated by *Baccharis pilularis* (coyote brush), non-native grassland (NNG) dominated by *Brassica* spp. (mustards), *Cardaria draba* (hoary cress), and *Conium maculatum* (poison hemlock), are present in non-wetland areas. A complete list of plant species observed and their WIS is included in Appendix 2. Map 6 illustrates the distribution of vegetation types within the project area.

3.2 Hydrology

Wetland hydrology was the most conserved wetland parameter. Drift lines, and drainage patterns in wetlands were the most common and extensive primary indicators of wetland hydrology. Along the main creek channel where steep banks are present, pronounced shelving is also present indicative of flow. In areas where the creek is bordered by rip-rap or shear cliffs, water staining is the primary indicator of wetland hydrology.

Figure 3. Vegetation bent from previous flow events provides evidence of drainage patterns in wetlands.

Saturation in the upper 12 inches was restricted to areas immediately adjacent to the main channel, within ephemeral feeder channels, and within hillside seeps.

Figure 4. The dark upper layer visible on this eroding cliff face is a silty clay loam reflective of relic hydric conditions

3.3 Soil

In many of the transects upstream of transect 7 (see Map 4), soil rather than hydrology is the most conserved wetland parameter. The incised channel itself consists of gullied land, where the soil profile has been largely destroyed by the down cutting of the creek (USDA 1972). Areas of soil from adjacent upland areas are present as well as sediments deposited by the waters of San Antonio Creek.

Dark Agueda silty clay loam, and Salinas silty clay loams, predominate in much of the upland areas bordering the project area. These soils were formed under conditions of poor drainage. These areas are now drained and the color reflects relic rather than present hydric conditions (USDA 1972). These soils are carried into the creek channel through erosion, landslides, and run-off, where they accumulate on benches within the incised channel supporting riparian vegetation. In such areas, hydrologic indicators are necessary to determine whether the soils are reflective of past or present conditions.

Indicator A5, stratified layers, (USDA 2006) is present in side channels and on low shelves. These areas appear to experience regular flows during the rainy season, which deposit fresh sediment on top of vegetation and detritus accumulated over the previous growing season, creating a layered appearance to the profile.

Gleys are primarily restricted to areas immediately adjacent to and within active channels. These areas appear to experience reducing conditions due to saturation throughout the growing season. A sulfidic odor originating from buried decaying vegetation accompanies most gleyed profiles. In areas that are only saturated for a portion of the growing season, low chroma colors predominate, but gleys are absent.

3.4 Waters of the United States

The boundaries of Waters of the United States include areas encompassed by the OHWM of San Antonio Creek, wetlands adjacent to the San Antonio Creek channel, and areas bound by the San Antonio Creek channel. Near average rainfall levels in the 2007-2008 rainy season indicate that the OHWM established during that rainy season is likely reflective of normal circumstances. A total of 4.75 acres within the project area constitute Waters of the United States. Map 7 illustrates the extent of the Waters of the United States within the project area.

Figure 5. Shelving on the bank (left) and sediment deposits (right) were two features used to determine the OHWM.

3.5 Field Surveys and Mapping

A total of 3.18 acres of wetlands were identified within the project area. Appendix 1 includes wetland delineation forms completed for each sample plot, and Appendix 2 includes a complete list of plant species observed during the wetland delineation. Maps 2, 3, 4, and 5 illustrate transect, sample plot, and wetland observation point locations. Map 6 illustrates vegetation types mapped within the project area. Map 7 illustrates the extent of Waters of the United States within the project area.

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Map 6. Vegetation Types

Project Area
Wetland
Wetland in Creek
Creek
RIP
RIP/CCS
CCS
CCS/NNG
NNG
RUD
NG
NNW
Rip-Rap
Buckwheat
Bare Ground
Buckwheat-Tarplant

N

Feet
0 250 500 750 1,000

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Map 7. Waters of the U.S.

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4.0 Conclusion

Wetland habitats were delineated within the 105-acre project area following protocols established in the USACE 1987 Wetland Delineation Manual. A total of 3.18 acres of wetland habitat (freshwater marsh) were identified within the project area during the February through April 2008 field surveys. Vegetation in wetland habitats consists for fresh water marsh and riparian vegetation types. Waters of the United States encompass those areas mapped as wetlands as well as areas of open water and areas bound or encompassed by the OHWM. A total of 4.75 acres within the project area constitute Waters of the United States.

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Appendix 1: Wetland Delineation Forms

A complete appendix of all wetland delineation forms cited herein is available upon request from 30 CES/CEV, 1515 Iceland Avenue, Room 181C, Vandenberg AFB, CA 93437-5319, e-mailed to 30CES.CEV@vandenberg.af.mil, or faxed to 805/606-6137.

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Appendix 2: Plant Species Observed

Species Name	Common Name	Status	Wetland Indicator Status
Acer negundo	Box elder	native	FACW
Amsinckia sp.	Fiddleneck	native	UPL
Artemisia californica	California sagebrush	native	UPL
Artemisia douglasiana	Mugwort	native	FAC+
Asphodelus fistulosus	Asphodel	exotic	UPL
Atriplex semibaccata	Australian saltbush	exotic	FAC
Avena barbata	Slender wild oats	exotic	UPL
Baccharis douglasii	Marsh baccharis	native	OBL
Baccharis pilularis	Coyote bush	native	UPL
Baccharis salicifolia	Mule fat	native	FACW
Brassica nigra	Black mustard	exotic	UPL
Brassica rapa	Field mustard	exotic	UPL
Bromus diandrus	Ripgut brome	exotic	UPL
Bromus hordeaceus	Soft-chess brome	exotic	FACU-
Calystegia macrostegia	Morning-glory	native	UPL
Carduus pycnocephalus	Italian thistle	exotic	UPL
Castilleja exserta	Owl's clover	native	UPL
Centaurea melitensis	Tacolote	exotic	UPL
Chenopodium californicum	California goosefoot	native	UPL
Chlorogalum pomeridianum	Soap root	native	UPL
Cirsium vulgare	Bull thistle	exotic	FAC
Clematis ligusticifolia	Virgin's bower	native	FAC
Conium maculatum	Poison hemlock	exotic	FAC
Conyza canadensis	Common horseweed	exotic	FAC
Cotula coronopifolia	Brass buttons	exotic	FACW+
Croton californicus	Croton	native	UPL
Cynodon dactylon	Bermuda grass	exotic	FACU
Cyperus eragrostis	Umbrella sedge	native	FACW
Deinandra increscens	Tarplant	native	UPL
Digitaria sanguinalis	Crabgrass	exotic	FACU
Distichlis spicata	Salt grass	native	FACW
Ehrharta calycina	Veldt grass	exotic	UPL
Epilobium ciliatum	Willow-herb	native	FACW
Ericameria ericoides	Mock heather	native	UPL
Eriogonum parvifolium	Seacliff buckwheat	native	UPL
Erodium botrys	Storkbill filaree	exotic	FACU
Erodium cicutarium	Redstem filaree	exotic	UPL
Euphorbia peplus	Petty spurge	exotic	UPL
Foeniculum vulgare	Fennel	exotic	FACU-
Galium aparine	Common bedstraw	native	FACU
Galium porrigens	Climbing bedstraw	native	UPL
Gnaphalium stramineum	Annual everlasting	native	FAC-
Gnaphalium californicum	California everlasting	native	UPL

Species Name	Common Name	Status	Wetland Indicator Status
Gnaphalium luteo-album	Cudweed	exotic	FACW-
Gnaphalium ramosissimum	Pink everlasting	native	UPL
Heliotropium curassavicum	Heliotrope	native	OBL
Heteromeles arbutifolia	Toyon	native	UPL
Heterotheca grandiflora	Telegraph weed	native	UPL
Hirschfeldia incana	Perennial mustard	exotic	UPL
Hordeum murinum	Foxtail barely	exotic	UPL
Juncus patens	Spreading rush	native	FAC
Lathyrus latifolius	Sweet-pea	exotic	UPL
Lepidium (Cardaria) draba	Heart-podded hoary cress	exotic	UPL
Leymus condensatus	Giant wild-rye	native	FACU
Leymus triticoides	Beardless wild-rye	native	FAC+
Lobularia maritima	Sweet alyssum	exotic	UPL
Lolium multiflorum	Italian ryegrass	exotic	UPL
Lotus scoparius	Deerweed	native	UPL
Malva nicaeensis	Mallow	exotic	UPL
Marah fabaceus	Manroot	native	UPL
Marrubium vulgare	Horehound	exotic	FACU
Medicago polymorpha	Bur-clover	exotic	FACU-
Melilotus sp.	Sweet-clover	exotic	FAC
Mimulus aurantiacus	Sticky monkeyflower	native	UPL
Nicotiana glauca	Tree tobacco	exotic	FAC
Phalaris minor	Phalaris	exotic	UPL
Picris echioides	Bristly ox-tongue	exotic	FAC
Plantago coronopus	Cutleaf plantain	exotic	FAC
Plantago lanceolata	English plantain	exotic	FAC-
Polygonum lapathifolium	Willow smartweed	native	OBL
Quercus agrifolia	Coast live oak	native	UPL
Raphanus sativus	Wild radish	exotic	UPL
Rorripa natsturtium-aquaticum	Watercress	native	OBL
Rosa californica	California rose	native	FAC+
Rubus ursinus	California blackberry	native	FAC+
Rumex acetosella	Sheep sorrel	exotic	FAC-
Rumex crispus	Curly dock	exotic	FACW-
Rumex salicifolius	Willow dock	native	FACW
Salix laevigata	Red willow	native	FACW+
Salix lasiolepis	Arroyo willow	native	FACW
Salix sitchensis	Shining willow	native	FACW+
Salsola tragus	Russian thistle	exotic	UPL
Sambucus mexicana	Blue elderberry	native	FACU
Sanicula crassicaulis	Common sanicle	native	UPL
Scirpus californicus	California tule	native	OBL
Scirpus americanus	American three-square	native	OBL

Species Name	Common Name	Status	Wetland Indicator Status
Scirpus microcarpus	Small-fruited bulrush	native	OBL
Scrophularia californica	California figwort	native	FAC
Silybum marianum	Milk thistle	exotic	UPL
Solanum douglasii	Black nightshade	native	FAC
Solanum xanti	Purple nightshade	native	UPL
Solidago confinis	Goldenrod	native	FAC
Sonchus asper	Prickly sow-thistle	exotic	FAC
Sonchus oleraceus	Common sow-thistle	exotic	NI
Spergularia bocconii	Sand-spurry	exotic	FAC
Spergularia marina	Sand-spurry	native	FACW
Toxicodendron diversilobum	Poison oak	native	UPL
Typha sp.	Cattail	native	OBL
Urtica dioica	Stinging nettle	native	FACW
Urtica urens	Dwarf nettle	exotic	UPL
Verbena lasiostachys	Vervain	native	FAC-
Vulpia myuros	Rattail fescue	exotic	FACU

APPENDIX E

Cultural Resources

Appendix E. Cultural Resources

E.1 Prehistory

The prehistory of California's Central Coast spans the entire Holocene and may extend back to late Pleistocene times. In the Santa Barbara Channel region, a fluted Clovis point found on the surface of a coastal site suggests use of the area possibly as early as 11,000–12,000 years ago (Erlandson et al. 1987), while a site on San Miguel Island has yielded a radiocarbon date of 10,300 B.P. (Erlandson 1991). Recent calibrations suggest that terminal Pleistocene radiocarbon dates are about 2,000 years too recent (Fiedel 1999), and thus these early sites may be even older. In San Luis Obispo County, excavations at CA-SLO-2 in Diablo Canyon revealed an occupation older than 9,000 years (Greenwood 1972; Moratto 1984), and investigations at CA-SLO-1797 indicate initial occupations as early as 10,300 B.P. (Fitzgerald 2000). Occupations on VAFB occurred by at least 9,000 years ago, based on radiocarbon dates from CA-SBA-246 and CA-SBA-931, both near the mouth of the Santa Ynez River (Glassow 1990, 1996; Lebow et al. 2001), and on radiocarbon dates from CA-SBA-530 (Woodman et al. 1995; Lebow et al. 2002).

Moratto (1984) refers to these early occupations as Paleocoastal. Population densities were probably low, judging from the limited number of sites dated to this period. Diagnostic tools associated with this time period have not been identified, although similarities with the San Dieguito Complex in southern California (Wallace 1978; Warren 1967) have been suggested (Erlandson 1994). Cultural assemblages have few of the grinding implements common to subsequent periods. These sites are characterized by a strong maritime orientation and an apparent reliance on shellfish. Occupants are thought to have lived in small groups that had a relatively egalitarian social organization and a forager-type land-use strategy (Erlandson 1994; Glassow 1996; Greenwood 1972; Moratto 1984).

Site densities throughout the central coast are higher during the subsequent periods, suggesting increased population size and possibly better site preservation. Sites dating between about 8,000 and 6,500 years ago often have relatively high densities of manos and milling slabs that are typically associated with processing seeds. These milling stones are diagnostic of this period. Shellfish appear to have continued as a dietary staple throughout the central coast (Erlandson 1994; Glassow and Wilcoxon 1988), including VAFB (Glassow 1996; Woodman et al. 1995). However, terrestrial mammals composed a larger portion of the diet on VAFB during this period than during any other time (Glassow 1996; Rudolph 1991). Fish were a larger part of the diet than shellfish at Morro Bay in San Luis Obispo County, although shellfish were better represented during this period than during subsequent periods (Jones et al. 1994).

Early scholars associated sites of this age with inland knolls and terraces (e.g., Rogers 1929), but subsequent investigations revealed that coastal environments were also used (e.g., Glassow et al. 1988). Well-developed middens at many sites suggest a more sedentary and stable settlement system (Breschini et al. 1983). Glassow (1990, 1996) infers that occupants of VAFB during this time were sedentary and had begun using a collector-type (i.e., logistically mobile) land-use strategy. Burial practices suggest that society was primarily egalitarian (Glassow 1996).

Population densities appear to have decreased substantially between 6500 and 5000 B.P. throughout the region, and little is known about this period. It is possible that arid conditions

associated with the Altithermal degraded the environment to the point that only low population densities were possible (Glassow 1996; Glassow and Wilcoxon 1988).

After 5000 B.P., population densities increased to pre-6500 B.P. levels as conditions became cooler and moister. Between 5000 and 3000 B.P., mortars and pestles became increasingly common throughout the region, suggesting intensified use of acorns (Basgall 1987), although these implements may have been associated with processing pulpy roots or tubers (Glassow 1997). Along the Santa Barbara Channel coastline, use of shellfish declined as other animal foods became more important. Use of more diverse environmental settings is suggested (Erlandson 1997). On VAFB, fish and sea mammals composed a larger part of the diet during this period. Large side-notched and stemmed projectile points became more prevalent in the archaeological record, presumably reflecting increased hunting, although Glassow (1996) suggests that proportions of terrestrial mammals do not surpass the pre-6500 B.P. levels. However, higher proportions of terrestrial mammals in archaeological assemblages are associated with this period in San Luis Obispo County. Increased logistical organization is suggested in this area (Jones et al. 1994; Jones and Waugh 1995). Proportions of obsidian (indicating exchange with other regions) increased after about 5000 B.P., particularly in San Luis Obispo County (Jones et al. 1994; Jones and Waugh 1995).

Cultural complexity appears to have increased around 3,000–2,500 B.P. Based on mortuary data from the Santa Barbara area, King (1981, 1990) suggests a substantial change in social organization and political complexity about 3,000 years ago. According to King, high-status positions became hereditary and individuals began to accumulate wealth and control exchange systems. Arnold (1991, 1992) proposes that this evolutionary step in socioeconomic complexity occurred around 700–800 years ago.

The period between 2,500 and 800 years ago is marked by increased cultural complexity and technological innovation. Fishing and sea mammal hunting became increasingly important, corresponding to development of the tomol (a plank canoe), single-piece shell fishhooks, and harpoons (Glassow 1996; King 1990). The bow and arrow also was introduced during this period (Glenn 1990, 1991). Sites in San Luis Obispo County suggest that use of terrestrial mammals remained high. Proportions of imported obsidian continued to increase during this period (Jones et al. 1994).

Arnold (1992) proposes that the complex Chumash sociopolitical system known at historic contact evolved substantially during a brief period between A.D. 1150 and 1300, which she terms the Middle-Late Transitional Period. Arnold infers that decreased marine productivity caused by elevated sea-surface temperatures resulted in subsistence stress that allowed an elite population to control critical resources, labor, and key technologies, resulting in hierarchical social organization and a monetary system. Although the issue of elevated sea-surface temperatures has been questioned (e.g., Kennett 1998) and the inference of marine degradation and subsistence stress has been challenged (e.g., Raab et al. 1995; Raab and Larson 1997), the full emergence of Chumash cultural complexity around this time is generally accepted.

On VAFB and in the Santa Barbara Channel region, population densities reached peak levels between 700 years ago and historic contact (Glassow 1990, 1996). Higher numbers of *Olivella* shell beads reflect increased exchange between the Channel Islands, the Santa Barbara mainland, and the VAFB area. Increased subsistence diversity is apparent. Although shellfish continued to be a dietary staple in the Vandenberg area, the use of fish and birds increased, proportions of secondary species in shellfish assemblages increased (Glassow 1990), and dietary expansion is evident (Lebow and Harro 1998). Correspondingly, the range and diversity of site types increased as a greater range of habitats and resources was used (Glassow 1990; Lebow and Harro 1998; Woodman et al. 1991). In San Luis Obispo County, the settlement system appears to have

changed substantially after 700 B.P. as residential bases along the coast were abandoned in favor of habitation sites farther inland. Coastal sites were used to obtain resources during short-term occupations (Breschini and Haversat 1988; Greenwood 1972; Jones et al. 1994; Jones and Waugh 1995). In addition, proportions of imported obsidian decreased substantially during this period (Jones et al. 1994).

E.2 Ethnohistory

People living in the VAFB area prior to historic contact are grouped with the Purisimeño Chumash (Greenwood 1978; King 1984; Landberg 1965), one of several linguistically related members of the Chumash culture. Their social organization, traditions, cosmology, and material culture are described by Blackburn (1975), Grant (1978a, 1978b, 1978c, 1978d), Greenwood (1978), Hudson et al. (1977), Hudson and Blackburn (1982, 1985, 1986), Hudson and Underhay (1978), Johnson (1988), and Landberg (1965).

Accounts of early explorers in the Santa Barbara Channel area indicate that the Chumash people lived in large, densely populated villages with well-built structures (e.g., Bolton 1927, 1930; Engelhardt 1933; Fages 1937; Moriarity and Keistman 1968; Simpson 1939; Teggart 1911; Wagner 1929). With a total Chumash-speaking population estimated at 18,500 (Cook 1976) and employing a maritime economy, the Chumash had a culture that "was as elaborate as that of any hunter-gatherer society on earth" (Moratto 1984). Leadership was hereditary and chiefs exercised control over more than one village, reflecting a simple chiefdom social organization. The Chumash engaged in craft specialization and maintained exchange systems (Arnold 1992; Johnson 1988).

Relatively little is known about the Chumash in the Vandenberg region. Explorers noted that villages were smaller and lacked the formal structure found in the channel area (Greenwood 1978). The Purisimeño Chumash at historic contact used approximately 22 villages, with populations between 30 and 200 per village (Glassow 1996). King (1984) identies about five ethnohistoric villages on VAFB, along with another five villages in the general vicinity.

Unfortunately, early explorers paid scant attention to Chumash subsistence and settlement systems. Using ethnohistoric, ethnographic, and archaeological data, Landberg (1965) attempted to reconstruct those facets of Chumash lifeways. Chumash subsistence relied primarily on fishing, hunting, and gathering plants (primarily acorns). In the spring, groups left their winter villages for temporary camps where they gathered grasses, roots, tubers, and bulbs. Hunting marine mammals became important during times when seals and sea lions congregated at their rookeries. Bulbs, roots, and tubers were gathered during the summer months as well, and seeds became important during this season, especially to the people north of Point Conception. Interior groups moved to the coast during the spring and summer to collect shellfish. Coastal groups returned to their villages in late summer and early fall to harvest large schooling fish such as tuna. Pine nuts were collected in the mountains during the fall months; acorns also were gathered in the late fall. Both of these resources, as well as berries collected during the late summer and early fall, were stored for use during the winter. Hunting also was important during the fall. Winter months were spent in villages, where residents relied primarily on stored foodstuffs as well as occasional fresh fish (Landberg 1965). Regional variation in subsistence strategies is evident in the ethnohistoric record (Landberg 1965); in the interior and along the northern coast of Chumash territory, marine resources were less important than acorns, seeds, and game (particularly deer).

Contact with early Euro-American explorers, beginning with the maritime voyages of Cabrillo in A.D. 1542–1543, undoubtedly had an effect on the Chumash culture. The effect may have been profound. Erlandson and Bartoy (1995, 1996) and Preston (1996) convincingly argue that Old

World diseases substantially impacted Chumash populations more than 200 years before Spanish occupation began in the 1770s.

Unquestionably, drastic changes to Chumash lifeways resulted from the Spanish occupation that began with the Portolá expedition in A.D. 1769. The first mission in Chumash territory was established in San Luis Obispo in 1772, followed in short order by San Buenaventura (1782), Santa Barbara (1786), and La Purísima Concepción, established in 1787 in the present location of Lompoc. The Mission Santa Ynez was established in 1804. Eventually, nearly the entire Chumash population was under the mission system (Grant 1978a). During the 1830s, the missions were secularized in an attempt to turn the mission centers into pueblos and make the Indians into Mexican citizens.

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MEMORANDUM OF AGREEMENT
BETWEEN
THE 30th SPACE WING OF THE UNITED STATES AIR FORCE, VANDENBERG A.F.B., AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER
REGARDING THE RECOVERY OF SIGNIFICANT INFORMATION FROM CA-SBA-3932, SAN ANTONIO CREEK STREAM RESTORATION PROJECT, SANTA BARBARA COUNTY, CALIFORNIA

WHEREAS, the 30th Space Wing of the United States Air Force, Vandenberg Air Force Base (VAFB) will prevent the collapse of San Antonio Road in Santa Barbara County, California, by implementing the San Antonio Creek Stream Restoration Project (Undertaking), and implementation of the Undertaking will result in the physical destruction of part of archaeological site CA-SBA-3932; and

WHEREAS, VAFB is assuming that CA-SBA-3932 is eligible for listing in the National Register of Historic Places (NRHP) under criterion d (36 CFR § 60.4) for the purposes of the Undertaking, and the State Historic Preservation Officer (SHPO) has acknowledged this assumption, and, as such, CA-SBA-3932 is a historic property as defined in 36 CFR Part 800, the regulation implementing Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 U.S.C. 470f), as amended; and

WHEREAS, VAFB considered a broad range of Undertaking alternatives and determined that constraints on the project design preclude the possibility of avoiding the physical destruction of part of the historic property during implementation and, as such, finds that the Undertaking will have an adverse affect on the historic property; and

WHEREAS, VAFB consulted the SHPO pursuant to 36 CFR Part 800 regarding the Undertaking's adverse effects on the historic property and notified the Advisory Council on Historic Preservation (ACHP) of the adverse effect finding pursuant to 36 CFR § 800.6(a)(1); and

WHEREAS, VAFB has chosen, owing to the unique circumstances surrounding the access restrictions to the historic property's deeply buried archaeological deposits, to combine a phased process to conduct final identification and evaluation of the historic property pursuant to 36 CFR § 800.4(b)(2) with a phased process to apply the criteria of adverse effect pursuant to 36 CFR § 800.5(a)(3) as specifically provided for in this Memorandum of Agreement (MOA); and

WHEREAS, VAFB will resolve the adverse effect of the Undertaking on the historic property pursuant to 36 CFR § 800.6(b)(1)(ii) using advice and conditions provided in the ACHP's *Recommended Approach for Consultation on the Recovery of Significant Information from Archeological Sites*, published in the Federal Register on 17 June 1999, and through the execution and implementation of this MOA; and

WHEREAS, the consulting parties agree that the recovery of significant information from the historic property may be done in accordance with the ACHP's standard treatments; and

WHEREAS, the consulting parties agree that it is in the public interest to expand funds to permit the recovery of significant information from the historic property as a means to mitigate the adverse effects of the Undertaking on the historic property to acceptable levels; and

WHEREAS, the Santa Ynez Band of Chumash Indians (Tribe), who may attach religious or cultural importance to the historic property, has been consulted regarding the Undertaking and its adverse effect on the historic property and will continue to be consulted, will be provided with the opportunity to

participate in the implementation of this MOA and of the Undertaking, and has been invited to concur in this MOA; and

WHEREAS, to the best of VAFB's knowledge and belief, no human remains, associated or unassociated funerary objects or sacred objects, or objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001) are expected to be encountered during the evaluation of and recovery of significant information from the historic property;

NOW, THEREFORE, VAFB and the SHPO agree that, upon VAFB's decision to proceed with the Undertaking, VAFB shall ensure that the Undertaking is implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on the historic property and further agree that these stipulations shall govern the Undertaking and all of its parts until this MOA expires or is terminated.

STIPULATIONS

VAFB shall ensure that the following measures are implemented:

I. AREA OF POTENTIAL EFFECTS

A. The Area of Potential Effects (APE) for the Undertaking is depicted in Figure 3 within the *Historic Property Treatment Plan: Resolving Adverse Effects to CA-SBA-3932 in Accordance with the Advisory Council on Historic Preservation's Standard Treatments for the Recovery of Significant Information from Archaeological sites, San Antonio Creek Stream Restoration Project, Vandenberg Air Force Base, Santa Barbara County, California* (June 2008) (Attachment A to this MOA). The APE was delineated to encompass all foreseeable project-related, ground-disturbing construction activities for all proposed alternatives, including areas required for the construction of the erosion control structures, staging and storage areas, and access and haul roads. As such, the APE encompasses the entire Area of Direct Impact (ADI). Additionally, where the APE encroached upon an archaeological site only partially it was adjusted to include the site in its entirety.

B. If modifications to the Undertaking take place subsequent to the execution of this MOA that necessitate the revision of either the APE or the ADI, VAFB will consult with the SHPO to facilitate mutual agreement on the subject revisions. If VAFB and the SHPO cannot reach agreement, then the parties will resolve the dispute in accordance with Stipulation VIII.B below. If VAFB and the SHPO reach mutual agreement on the proposed revisions, then VAFB will submit a final map of the revisions no later than 30 days following such agreement.

II. FINAL IDENTIFICATION AND EVALUATION OF HISTORIC PROPERTIES

VAFB has chosen, in accordance with 36 CFR §800.4(b)(2) and 36 CFR §800.5(a)(3), to complete final identification and evaluation of, and application of the criteria of adverse effects for, one historic property within the Undertaking's APE that cannot be avoided subsequent to VAFB's approval of the Undertaking. VAFB chose to implement phased identification, evaluation, and application of the criteria of adverse effect because access to the historic property's most deeply buried archaeological deposits is restricted by more than 5 meters of soil. VAFB shall, upon its decision to proceed with the Undertaking, and when it gains access to the subject deposits, complete its effort to identify, evaluate and apply the criteria of adverse effect to the subject historic property in accordance with 36 CFR §800.4 and 36 CFR §800.5. Following the completion of fieldwork, a letter report documenting fieldwork and preliminary

results will be distributed to the MOA parties and the Tribe for review and comment. The letter report will serve as notice that VAFB completed Stipulation II of this MOA and is proceeding with the remaining applicable stipulations. Full and final results will be included in a report of findings on NRHP eligibility, assessment of adverse effects, and data recovery in accordance with Stipulation IV.B below.

III. TREATMENT OF HISTORIC PROPERTIES

A. VAFB shall ensure that the adverse effect of the Undertaking on CA-SBA-3932 is resolved in part by implementing the *Historic Property Treatment Plan: Resolving Adverse Effects to CA-SBA-3932 in Accordance with the Advisory Council on Historic Preservation's Standard Treatments for the Recovery of Significant Information from Archaeological Sites, San Antonio Creek Stream Restoration Project, Vandenberg Air Force Base, Santa Barbara County, California* dated June 2008 (hereafter DRP) (Attachment A to this MOA).

B. VAFB shall include provisions to ensure against incidental damage to historic properties with near-surface archaeological deposits within the APE. These provisions call for the establishment of Exclusionary Areas using orange mesh temporary fencing as specified in the APE map (Figure 3 within the DRP).

C. Historic properties [36 CFR § 800.16(l)(1)] identified subsequent to the implementation of Stipulation II of this MOA that cannot be avoided shall be treated pursuant to the DRP.

D. Any MOA party may propose modifications to the DRP. Such modifications will not require amendment of this MOA. Disputes regarding modifications proposed hereunder shall be addressed through further consultation among the MOA parties, and a reasonable time frame for such consultation shall be established by VAFB. If the dispute is resolved within this time frame, the MOA parties shall proceed in accordance with the terms of that resolution. If the dispute is not resolved within this time frame, VAFB shall render a final decision regarding the dispute and the MOA parties shall proceed in accordance with the terms of that decision. Consultation on DRP modifications shall be no less than 15 days and no more than 30 days.

E. VAFB will not authorize the execution of any Undertaking activity that may affect [36 CFR§ 800.16(i)] historic properties in the Undertaking's APE until the requirements set forth in sections A and B of this stipulation have been met.

F. Signatories to this MOA agree that only cultural resources determined to be eligible for listing in the NRHP pursuant to Stipulation II will be subject to further consideration under the terms of the MOA.

IV. REPORTING REQUIREMENTS AND RELATED REVIEWS

A. Within 30 days after VAFB determines that all fieldwork required by Stipulations II and III is complete, VAFB will ensure preparation, and concurrent distribution to the MOA parties and the Tribe, for review and comment, of a letter report summarizing fieldwork and preliminary results.

B. Within 24 months after VAFB determines all fieldwork required by Stipulations II and III.A is complete, VAFB will ensure preparation, and concurrent distribution to the MOA parties and the Tribe, for review and comment, of a written draft technical report that documents the results of

implementing the DRP. The reviewing parties will be afforded 30 days following receipt of the draft technical report to submit any written comments to VAFB. Failure of these parties to respond within this time frame shall not preclude VAFB from authorizing revisions to the draft technical report as VAFB may deem appropriate. VAFB will provide the reviewing parties with written documentation indicating whether and how the draft technical report will be modified in accordance with any reviewing party comments. Unless any reviewing party objects to this documentation in writing to VAFB within 30 days following receipt, VAFB may modify the draft technical report as VAFB may deem appropriate. Thereafter, VAFB may issue the technical report in final form and distribute it in accordance with Paragraph C of this stipulation.

C. Copies of the final technical report documenting the results of the DRP implementation will be distributed by VAFB to the other MOA parties, to the Tribe, and to the Central Coastal California Information Center of the California Historical Resources Information System housed at the University of California, Santa Barbara.

V. NATIVE AMERICAN CONSULTATION

VAFB has consulted with the Tribe regarding the Undertaking and its effects on historic properties, will continue to consult with them, and has invited them to participate in the implementation of the terms of this MOA, in the implementation of the Undertaking, and concur in this MOA. If the Tribe chooses to participate, VAFB will further consult regarding the manner of such participation, including discussions on time frames or other matters that may govern the nature, scope and frequency of such participation.

VI. TREATMENT OF HUMAN REMAINS

CA-SBA-3932 is not known to contain human remains. The MOA parties agree that human remains and related items discovered during implementation of the MOA and of the Undertaking will be treated in accordance with the Written Plan of Action for the Treatment of Human Remains in Accordance with the Native American Graves Protection and Repatriation Act, an agreement between VAFB and the Tribe, the Most Likely Descendants designated pursuant to the California Public Resources Code 5097.98.

VII. DISCOVERIES AND UNANTICIPATED EFFECTS

If VAFB determines, during implementation of the DRP or after construction of the Undertaking has commenced, that either the implementation of the DRP or the Undertaking will affect a previously unidentified property that may be eligible for the National Register, or affect a known historic property in an unanticipated manner, VAFB will address the discovery or unanticipated effect in accordance with 36 CFR § 800.13(b)(3). VAFB at its discretion may hereunder, and pursuant to 36 CFR § 800.13(c) assume any discovered property to be eligible for inclusion in the National Register.

VIII. ADMINISTRATIVE PROVISIONS

A. STANDARDS

1. Professional Qualifications. All activities prescribed by stipulations I, II, III, IV and VI of this MOA shall be carried out under the authority of VAFB by or under the direct supervision of a person or persons meeting at a minimum the Secretary of the Interior's *Professional*

Qualifications Standards (48 FR 44738-39, September 29, 1983) (hereafter PQS) in the appropriate disciplines. However, nothing in this stipulation may be interpreted to preclude VAFB or any agent or contractor thereof from using properly supervised persons who do not meet the PQS.

2. Historic Preservation Documentation Standards. Activities prescribed by stipulations II, III, IV, VI, and VII of this MOA shall conform to the *Secretary of the Interior's Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as to applicable standards and guidelines established by the SHPO.

3. Curation and Curation Standards. VAFB shall ensure that, to the extent permitted under §§ 5097.98 and 5097.991 of the California Public Resources Code, the materials and records resulting from the historic preservation work prescribed by this MOA are curated in accordance with 36 CFR Part 79.

B. CONFIDENTIALITY

The MOA parties acknowledge that historic properties covered by this MOA are subject to the provisions of Section 304 of the NHPA [16 U.S.C. 470w-3(a)] relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this MOA are consistent with said section.

C. DISPUTE RESOLUTION

1. Should any MOA party object to the manner in which the terms of this MOA are implemented, to any action carried out or proposed with respect to implementation of the MOA (other than the Undertaking itself), or to any documentation prepared in accordance with and subject to the terms of this MOA, VAFB shall immediately notify the other MOA parties of the objection and consult with the objecting party and the other parties to this MOA for no more than fourteen days to resolve the objection. VAFB shall reasonably determine when this consultation will commence and may extend this consultation period. If the objection is resolved through such consultation, the action in dispute may proceed in accordance with the terms of that resolution. If, after initiating such consultation, VAFB determines that the objection cannot be resolved through consultation, then VAFB shall forward all documentation relevant to the objection to the ACHP, including VAFB' proposed response to the objection, with the expectation that the ACHP, within thirty days after receipt of such documentation, will:

    a. advise VAFB that the ACHP concurs in VAFB' proposed response to the objection, whereupon VAFB will respond to the objection accordingly. The objection shall thereby be resolved; or

    b. provide VAFB with recommendations, which VAFB will take into account in reaching a final decision regarding its response to the objection. The objection shall thereby be resolved; or

    c. notify VAFB that the objection will be referred for comment pursuant to 36 CFR §800.7(c), and proceed to refer the objection and comment. VAFB shall take the resulting comments into account in accordance with 36 CFR § 800.7(c)(4) and Section 110(1) of the NHPA. The objection shall thereby be resolved.

2. Should the ACHP not exercise one of the aforementioned options within thirty days after receipt of all pertinent documentation, VAFB may assume the ACHP's concurrence in its proposed response to the objection. The objection shall thereby be resolved.

3. VAFB shall take into account any ACHP recommendation or comment provided in accordance with section C.1 of this stipulation with reference only to the subject of the objection. VAFB' responsibility to carry out all actions under this MOA that are not the subject of the objection will remain unchanged.

4. At any time during implementation of the measures stipulated in this MOA, should an objection pertaining to such implementation be raised by a member of the public, VAFB shall notify the MOA parties in writing of the objection and take the objection into consideration. VAFB shall consult with the objecting party and, if the objecting party so requests, with the other MOA parties for no more than fifteen days. Within ten days following closure of this consultation period, VAFB will render a decision regarding the objection and notify all consulting parties of its decision in writing. The objection will thereby be resolved. In reaching its decision, VAFB will take into account any comments from the consulting parties regarding the objection, including the objecting party. VAFB' decision regarding the resolution of the objection will be final.

5. VAFB shall provide all MOA parties, and the ACHP when the ACHP has issued comments hereunder, and any parties that have objected pursuant to section C. 4 of this stipulation with a copy of its final written decision regarding any objection addressed pursuant to this stipulation.

6. VAFB may authorize any action subject to objection under section C of this stipulation to proceed after the objection has been resolved in accordance with the terms of section C.1.

D. AMENDMENTS

1. Any MOA party may propose that this MOA be amended, whereupon the MOA parties will consult for no more than 30 days to consider such amendment. VAFB may extend this consultation period. The amendment process shall comply with 36 CFR §800.6(c)(1) and 800.6(c)(7). This MOA may be amended only upon the written agreement of the signatory parties. If it is not amended, this MOA may be terminated by either signatory party in accordance with section E of this stipulation.

2. Attachment A to this MOA (the DRP) may be amended through consultation as prescribed in section B of Stipulation I or section D of Stipulation III, as appropriate, without amending the MOA proper.

E. TERMINATION

1. If this MOA is not amended as provided for in section D.1 of Stipulation VIII, or if either signatory party proposes termination of this MOA for other reasons, the signatory party proposing termination shall, in writing, notify the other MOA parties explaining the reasons for proposing termination, and consult with the other MOA parties for at least 30 days to seek alternatives to termination. Such consultation shall not be required if VAFB proposes termination because the Undertaking no longer meets the definition set forth in 36 CFR § 800.16(y).

2. Should such consultation result in an agreement or amendment on an alternative to termination, then the MOA parties shall proceed in accordance with the terms of that agreement and if such agreement is an amendment, then the MOA parties shall comply with section D.1 of Stipulation VIII.

3. Should such consultation fail, the signatory party proposing termination may terminate this MOA by promptly notifying the other MOA parties in writing. Termination hereunder shall render this MOA without further force and effect.

4. If this MOA is terminated hereunder, and if VAFB determines that the Undertaking will nonetheless proceed, then VAFB shall either consult in accordance with 36 CFR § 800.6 to develop a new MOA, or request the comments of the ACHP, pursuant to 36 CFR § 800.6 and 800.7.

F. DURATION OF THE MOA

1. This MOA will be in effect following execution by the signatory parties until VAFB, in consultation with the other parties, determines that all of its stipulations have been satisfactorily fulfilled. This MOA will terminate and have no further force or effect on the day that VAFB notifies the other MOA parties in writing of its determination that all stipulations of this MOA have been satisfactorily fulfilled.

2. The terms of this MOA shall be satisfactorily fulfilled within five (5) years following the date of execution by the signatory parties. If VAFB determines that this requirement cannot be met, the MOA parties will consult to reconsider its terms. Reconsideration may include continuation of the MOA as originally executed, amendment of the MOA, or termination. In the event of termination, VAFB will comply with section E.4 of this stipulation if it determines that the Undertaking will proceed notwithstanding termination of this MOA.

3. If the Undertaking has not been implemented within 5 years following execution of this MOA by the signatory parties, this MOA shall automatically terminate and have no further force or effect. In such event, VAFB shall notify the other MOA parties in writing and, if it chooses to continue with the Undertaking, shall reinitiate review of the Undertaking in accordance with 36 CFR Part 800.

G. EFFECTIVE DATE

This MOA will take effect on the date that it has been executed by VAFB and the SHPO.

EXECUTION of this MOA by VAFB and the SHPO, its transmittal by VAFB to the ACHP in accordance with 36 CFR § 800.6(b)(1)(iv), and subsequent implementation of its terms, shall evidence, pursuant to 36 CFR § 800.6(c), that this MOA is an agreement with the ACHP for purposes of Section 110(1) of the NHPA and shall further evidence that VAFB afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties, and that VAFB has taken into account the effect of the Undertaking on historic properties.

SIGNATORY PARTIES:

30th Space Wing of the United States Air Force, Vandenberg Air Force Base

By: _____ Date: 28 AUG 2009

DAVID C. PIECH, Lt Col, USAF
Commander, 30th Civil Engineer Squadron

California State Historic Preservation Officer

By: _____ Date _____

MILFORD WAYNE DONALDSONS, FAIA
State Historic Preservation Officer

INVITED CONCURRING SIGNATORY:

Santa Ynez Band of Chumash Indians

By: _____ Date _____

Tribal Representative

Attachments

A Historic Property Treatment Plan: Resolving Adverse Effects to CA-SBA-3932 in Accordance with the Advisory Council on Historic Preservation's Standard Treatments for the Recovery of Significant Information from Archaeological Sites, San Antonio Creek Stream Restoration Project, Vandenberg Air Force Base, Santa Barbara County, California (June 2008)

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *Governor*

OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 942896
SACRAMENTO, CA 94296-0001
(916) 653-6624 Fax: (916) 653-9824
calshpo@ohp.parks.ca.gov
www.ohp.parks.ca.gov

September 2, 2008

In Reply Refer To: USAF080604A

David C. Piech, Lt Col, USAF
Commander, 30th Civil Engineer Squadron
Department of the Air Force
30th Space Wing (AFSPC)
1172 Iceland Avenue
Vandenberg AFB, California 93437-6012

Re: Execution of Memorandum of Agreement for the San Antonio Creek Stream Restoration Project, Vandenberg Air Force Base, Santa Barbara County, California..

Dear Mr. Piech:

Enclosed are the executed copies of the *Memorandum of Agreement Between the 30th Space Wing of the United States Air Force, Vandenberg A.F.B, and the California State Historic Preservation Officer Regarding the Recovery of Significant Information From CA-SBA-3932, San Antonio Creek Stream Restoration Project, Santa Barbara County, California* (MOA). Please provide my office with a fully executed copy of this MOA when it has been signed by the concurring party.

If you require further information, please contact William Soule, Associate State Archeologist, at phone 916-654-4614 or email wsoule@parks.ca.gov.

Sincerely,

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

EXECUTION of this MOA by VAFB and the SHPO, its transmittal by VAFB to the ACHP in accordance with 36 CFR § 800.6(b)(1)(iv), and subsequent implementation of its terms, shall evidence, pursuant to 36 CFR § 800.6(c), that this MOA is an agreement with the ACHP for purposes of Section 110(1) of the NHPA and shall further evidence that VAFB afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties, and that VAFB has taken into account the effect of the Undertaking on historic properties.

SIGNATORY PARTIES:

30th Space Wing of the United States Air Force, Vandenberg Air Force Base

By: _____ Date: 28 AUG 2008

DAVID C. PIECH, Lt Col, USAF
Commander, 30th Civil Engineer Squadron

California State Historic Preservation Officer

By: _____ Date 2 SEP 2008

MILFORD WAYNE DONALDSONS, FAIA
State Historic Preservation Officer

INVITED CONCURRING SIGNATORY:

Santa Ynez Band of Chumash Indians

By: _____ Date _____

Tribal Representative

Attachments

A Historic Property Treatment Plan: Resolving Adverse Effects to CA-SBA-3932 in Accordance with the Advisory Council on Historic Preservation's Standard Treatments for the Recovery of Significant Information from Archaeological Sites, San Antonio Creek Stream Restoration Project, Vandenberg Air Force Base, Santa Barbara County, California (June 2008)